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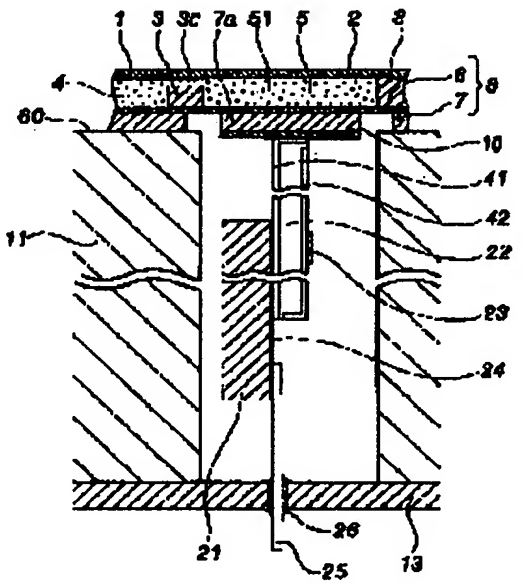
(54) INK JET PRINTING HEAD AND MANUFACTURE THEREOF

(57)Abstract:



PURPOSE: To stabilize the high-speed-response jetting characteristics, by providing an intermediate member in the part where an elastic member contacts with a piezoelectric element, the width of the intermediate member in the direction in which a plurality of piezoelectric elements are arranged in parallel being smaller than the widths of the elastic member and the piezoelectric element, and by fixing it with an adhesive.
CONSTITUTION: A piezoelectric element 22 in which electric fields are applied to both electrodes 41 and 42 contracts lengthways, however, the lower half of the piezoelectric element 22 is fixed to an anchor block 21 holding by means of a head frame 11 and cannot contract and move from the place, while the upper half contracts and moves from its place and pulls an elastic member 8 via an intermediate member 10. The thin metal plate 6 of the pulled elastic member 8 warps downward, the volume of an ink chamber 5 expands to cause ink 51 to flow in from a reservoir 4 via an ink supply mouth 3c. Subsequently, when the piezoelectric element 22 is released from the electric fields, the ink chamber 5 is compressed, so that droplets of ink are jetted from the nozzle 2. The intermediate member 10 is an insulated member, its width in the direction in which a plurality of piezoelectric elements 10 are arranged in parallel is smaller than the widths of the elastic member 8 and the piezoelectric element 10. A fluid substance for forming the intermediate member 10 is applied to the elastic member 8 and cured.

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CLAIMS

[Claim(s)]
[Claim 1] The elastic member which forms a part of ink room, and the piezoelectric device which it corresponds to an one to one and is arranged in this take joint structure. In the ink-jet formula print head which the aforementioned elastic member is displaced [print head] by the aforementioned piezoelectric device, heightens [print head] the ink pressure of the ink interior of a room, and makes an ink drop breathe out from a nozzle It is the ink-jet formula print head which prepares pars intermedia material in the portion to which the aforementioned piezoelectric device contacts the aforementioned elastic member, and is characterized by the width of face of the aforementioned pars intermedia material in the aforementioned piezoelectric-device two or more parallel direction being narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and fixing adhesion.
[Claim 2] The manufacture method of the ink-jet formula print head characterized by applying adhesives in the shape of a thin film, imprinting the thin layer of the aforementioned adhesives in an ink-jet formula print head according to claim 1 to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention breathes out an ink drop according to a printing signal, and relates to the recording head and its manufacture method of the on-demand type ink jet printer which forms an ink image on record media, such as the recording paper.
[0002]
[Description of the Prior Art] As shown in Japanese patent official report Japanese Patent Publication No. No. 45985 [two to], and JP,2-52625,B, the so-called recording head of the on-demand type ink jet printer which makes an ink drop fly according to a printing signal makes the other end of the piezoelectric device by which the end was fixed to the pedestal contact the elastic wall of the container which forms an ink room through the leg, and is constituted. the member which adjoins the member from which this leg constitutes an elastic wall -- translational motion in alignment with the bearing means of inner cylindrical opening is carried out According to the technology of this official report, a piezoelectric device is shrunk, ink room volume is increased, ink room volume is decreased by expanding a piezoelectric device again, and ink is breathed out as a drop from the nozzle. Furthermore, the composition of this technology has taken the structure of carrying out the line contact of the leg to a bearing means, and making it supporting.
[0003]
[Problem(s) to be Solved by the Invention] The size of a piezoelectric device or an ink room becomes small, so that miniaturization of a recording head and densification are attained. the composition of the above-mentioned official report -- a leg member and leg insertion bearing composition -- it is the structure which carries out the laminating of the member of complicated configurations, such as a member, and it is very difficult to manage the size of the miniaturized each part material with high precision, and to manufacture it That is, it has the trouble that it is difficult to acquire the contact state of the leg and the leg insertion bearing composition member which transmit the generating force from a piezoelectric device for required accuracy in two or more ink regurgitation equipments.
[0004] moreover, the leg mutual [of ink regurgitation equipment] in transfer of the generating force from a piezoelectric device, and multiple -- the same leg insertion bearing composition -- a member -- it has the trouble of interfering in order to carry out translational motion inside
[0005] Furthermore, the rigid lowered piezoelectric device which became small [a size] is made included in the regular position, the load to the aforementioned transection direction to a piezoelectric device is added, and the alignment at the time of arranging in a piezoelectric device and the leg the alignment or the engagement means of a piezoelectric device and the pi zoelectric device to the leg structure which prevents the lateroduction of the transection direction to the piezoelectric-device major axis of a piezoelectric device by the coupling means of the leg has the trouble of spoiling the reliability of a piezoelectric device.
[0006] It has the trouble that the rigidity of a bond part is low since mechanical coupling means are moreover used between the leg and the elastic wall, and the high-speed responsibility of the ink regurgitation is not obtained.

[0007] Then, the overall purpose of this invention is to offer the joint structure where it was improved between the piezoelectric transducer and the elastic wall.
[0008] Other purposes of this invention are to offer the cheap joint method.
[0009] Other purposes of this invention are to offer the joint structure and the joint manufacture method of mass-producing easily.
[0010] It is in other purposes of this invention offering the joint method that a uniform performance can be demonstrated with two or more ink regurgitation equipments with little piezoelectric-device generating force loss.
[0011] Other purposes of this invention are to offer the joint structure which prevents a mutual interference of ink regurgitation equipment.
[0012] Other purposes of this invention are to offer the joint method of having reliability.
[0013] Other purposes of this invention are to offer the joint method which the high-speed responsibility of the ink regurgitation has.
[0014]
[Means for Solving the Problem] The elastic member in which the ink-jet formula print head of this invention forms a part of ink room, In the ink-jet formula print head which joint structure is taken with the piezoelectric device which it corresponds to an one to one and is arranged in this, the variation rate of the aforementioned elastic member is carried out [print head] by the aforementioned piezoelectric device, it heightens [print head] the ink pressure of the ink interior of a room, and makes an ink drop breathe out from a nozzle Pars intermedia material is prepared in the portion to which the aforementioned elastic member and the aforementioned piezoelectric device contact at least one side of the aforementioned elastic member and the aforementioned piezoelectric device. And the width of face of the aforementioned pars intermedia material in the aforementioned piezoelectric-device two or more parallel direction is narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and each part material is characterized by fixing adhesion. Furthermore, the manufacture method of the ink-jet formula print head characterized by imprinting the thin layer of the adhesives which applied adhesives to the thin film and were applied on the aforementioned thin film in the manufacture method to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.
[0015]
[Example] Drawing 1 is the perspective diagram showing the composition of one example of this invention, and disassembles each part article after assembly. Drawing 2 , drawing 3 , drawing 4 , and drawing 5 show the fragmentary sectional view which drew this example on the detail more, the fragmentary sectional view which rotated the aforementioned fragmentary sectional view of this example 90 degrees, the partial perspective diagram which looked at this example from the lower part, and the part plan which looked at this example from right above, respectively. In addition, drawing 5 shows the state where the component part was penetrated one by one from the top. The fragmentary sectional view drawing 6 explains the conventional trouble to be, and drawing 7 show the fragmentary sectional view explaining the effect in the structure of this invention. Drawing 8 and drawing 9 show the fragmentary sectional view for explaining one example of the manufacture method of an ink room. Drawing 10 shows the fragmentary sectional view for explaining the manufacture method which forms pars intermedia material based on the composition of the example of this invention. Drawing 11 shows the fragmentary sectional view for explaining the manufacture method of this invention based on the example of this invention. Drawing 12 and drawing 13 show the fragmentary sectional view for explaining other examples of this invention.
[0016] In these drawings, 1 is a nozzl substrate. Two or more nozzles 2 are formed in the nozzle substrate 1. 3 is a cavity formation substrate. The cavity formation substrate 3 is pinched by the elastic member 8 used as the nozzle substrate 1 and an elastic wall, and forms a reservoir 4 and the ink room 5. An elastic member 8 accomplishes the laminated structure which consists of a sheet metal 6 and wall material 7. After adhesion junction is carried out one by one

and an elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 form a cavity, they form in an elastic member 8 side the pars intermedia material 10 mentioned later, and adhesion junction is carried out on the head frame 11.
[0017] this invention is explained based on drawing 1 . The piezoelectric device 22 used as the driving source of the ink drop regurgitation fixed the whole surface of the abbreviation half of the longitudinal direction to standing ways 21, and has joined the nose of cam 50 of the half which does not fix to the pars intermedia material 10. The flow circuit pattern 24 of a positive electrode and a negative electrode is given to standing ways 21, and the electric field controlled by the control board 13 are given to a piezoelectric device 22 through a leadframe 25. 11 is a head frame. 12 is the installation hole which penetrates the inside of the head frame 11, and supports standing ways 21 to carry out X of a piezoelectric device 22, and alignment (to refer to the XYZ coordinate of drawing 1) of the direction of Y. In addition, the Z direction of a piezoelectric device 22 carries out alignment of the nose of cam 50 of a piezoelectric device 22 in contact with the pars intermedia material 10 after joining the zygote which joined the pars intermedia material 10, the elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 to the head frame 11.
[0018] 31 is an ink supply pipe which supplies ink 51 from an ink reservoir (not shown). Pressing junction of the ink supply pipe 31 is carried out at the head frame 11. Ink passage is open for free passage through the ink end connection 32 in the head frame 11, and the ink connection mouth 33 in an elastic member 8 with the reservoir 4 of the cavity formation substrate 3, and also the ink room 5. The above is outline composition.
[0019] According to drawing 2 and drawing 3 , structure is described in more detail. Drawing 2 is a fragmentary sectional view when disconnecting one piezoelectric device of the piezoelectric device 22 which carries out two or more parallel (the direction of X of drawing 1) from a center in the direction of Y of drawing 1 . Wall material 7a which the piezoelectric device 22 of an elastic member 8 contacts through the pars intermedia material 10 is aiming at rigid reinforcement to the sheet metal 6 in order to obtain uniformly as much as possible the amount of displacement of the elastic wall of the ink room 5 at a large area, since the ink room cross section is larger than the contact section cross section of a piezoelectric device 22. One electrode 42 of one electrode 41 and others has countered. [piezoelectric device / 22] Electrical connection of the electrode 41 is carried out to the circuit pattern 24 on standing ways 21 simultaneously with junction. Electrical connection of other electrodes 42 is carried out to the circuit pattern 24 on standing ways 21, and the electrode contrary to especially the electrode 41 with the common board 23. The circuit pattern 24 and the control board 13 were connected with the leadframe 25, and the connection place is fixed with solder 26, respectively. In addition, standing ways 21 are in the state to which the piezoelectric device 22 contacted the pars intermedia material 10, and junction fixation is carried out at the head frame 11. That is, alignment of the Z direction of a piezoelectric device 22 is carried out by the pars intermedia material 10. The flat surface 60 of the head frame 11 which contacts the wall material 7 is finished with high precision by meanses, such as flat-surface polish.
[0020] Drawing 3 is a fragmentary sectional view when cutting from a center in the direction of X of drawing 1 of the piezoelectric device 22 arranged in parallel. [two or more] The nozzle substrate 1, the cavity formation substrate 3, and an elastic member 8 are the laminated structures which carried out adhesion junction, in order to carry out adhesion junction, the wall material 7 of an elastic member 8 needs to apply a junction pressure to wall 3e which contacts the nozzle substrate 1 and an elastic member 8 and which separates between an ink room, and wall material 7a which transmits the generating force from a piezoelectric device 22 arranges wall material 7b independently.
[0021] On the other hand, the ink room 5 and reservoir 4 with which it fills up with ink 51 are formed lik drawing 5 by the cavity formation substrate 3, the nozzle substrate 1, and the elastic member 8. Although the cavity formation substrate 3 can be made with etching processing of glass, the laminating of a sheet metal, exposure formation of a photopolymer, injection molding of a resin, etc., the photopolymer cheap in cost is used for it by this example. The wrap nozzle substrate 1 consists the upper surface of the cavity formation substrate 3 of a stainless steel

plate with which every one nozzle 2 was opened in two or more ink rooms 5, respectively and which is about 0.1mm by press working of sheet metal. The nozzle substrate 1 can be made also by the nickel-electroforming processing method. Moreover, the structure which carried out the laminating of the wall material 7 formed in the thickness of about 10-100 micrometers by the said processing method to the sheet metal 6 by which the wrap elastic member 8 formed the inferior surface of tongue of the cavity formation substrate 3 in the thickness of 5 micrometers or less by the nickel-electroforming processing method is made. The wall material 7 can acquire a required configuration easily by applying a resist. Although a sheet metal 6 is so desirable that it is thin in order to tell expansion and contraction of a piezoelectric device 22 efficiently to the ink room 5, the ink 51 in the ink room 5 must not ooze out. It is because ink 51 adheres between one electrode 41 of a piezoelectric device 22, and one of other electrodes 42, and to a control board 13 and it short-circuits electrically, when ink 51 presents conductivity. Moreover, resins, such as a film, can also be substituted for a sheet metal 6. Although it will become simple as composition if a piezoelectric device 22 is directly joined to a sheet metal 6, this is not made for the following reasons. The piezoelectric device which adjoins if an electrode 41 contacts a sheet metal 6 as one reason as shown in drawing 2 will connect too hastily. Temporarily, ink 51 will be joined by electric field when an electrode 41 side is used as a common electrode. This leads to ink 51 ionizing with time and causing degradation of reliability. Then, by allotting insulating member, i.e., a photopolymer, to the pars intermedia material 10, it will be released from the above-mentioned problem and the flexibility of the wiring for controlling a piezoelectric device 22 will increase. Another reason has the cross-section configuration of a piezoelectric device 22, and the cross-section configuration of the ink room 5 in differing from a cost side and the reasons of manufacture, as shown in drawing 5 . In case a piezoelectric device 22 carries out the pressurization and decompression of the ink room 5, as this is shown in drawing 5 , the length (b) of an elastic member 8 which can be displaced is too short, and it cannot fully bend, but it will elapse and the length (b) of an elastic member 8 which can be displaced conversely will absorb the pressure [being long] to generate. Therefore, in order to carry out the pressure transfer of the variation rate of a piezoelectric device 22 efficiently at the ink room 5, the middle transfer member which can secure a length (b) (b) appropriately is needed. Wall material 7a which has rigidity from the reason for the above is needed. Therefore, wall material 7a is designed somewhat smaller than the plane of projection of the ink room 5 so that it may bend as shown in drawing 5 , and an amount can be secured. The form which shows wall material 7a in drawing 4 by the electroforming method is made. Moreover, as shown in drawing 7 , the pars intermedia material 10 is formed for margin increase of the alignment of the nose of cam 50 of a piezoelectric device 22, and wall material 7a, and, as for the end face of wall material 7a which is an insular part, the nose of cam 50 of a piezoelectric device 22 is joined to this.

[0022] Here, ink drop discharging is explained using drawing 2 . According to a printing signal, electric field are impressed to one electrode 41 of a piezoelectric device 22, and one of other electrodes 42 through a leadframe 25 and a circuit pattern 24 from a control board 13. It is going to contract the piezoelectric device 22 to which electric field were impressed to a longitudinal direction (this drawing vertical direction). At this time, the lower half of a piezoelectric device 22 has fixed to the standing ways 21 held at the head frame 11, and cannot carry out contraction displacement. On the other hand, the upper half of a piezoelectric device 22 carries out contraction displacement, without receiving other restraints, and pulls an elastic member 8 through the pars intermedia material 10 with the shrinkage force. The sheet metal 6 of the elastic member 8 pulled by the piezoelectric device 22 through the pars intermedia material 10 bends below, and, as a result, the volume of the ink room 5 expands. If the ink room 5 expands, ink 51 will flow through ink feed-hopper 3c from a reservoir 4. Subsequently, if the electric field of a piezoelectric device 22 are canceled, it will elongate to the original length and a piezoelectric device 22 will compr ss the ink room 5. The regurgitation of the ink drop is carried out from a nozzle 2 by this pressure. Wall material 7a of the pars intermedia material 10 and an elastic member 8 which tells the variation rate of a piezoelectric device 22 to the ink room 5 pressurizes and decompresses the ink room 5 uniformly, leaving the deflection section of a sheet metal 6, since it is somewhat smaller than the plane of projection of the ink room 5, as

mentioned above.
[0023] By the way, in the conventional example of joint structure which do s not form the pars intermedia material 10 of this invention, two or more ink rooms 5 are close, and the leg 27 is arranged in an one to one. Piezoelectric-device 22a and the leg 27 are joined directly [after / contact], in order to abolish loss at the time of generating force transfer. However, by the alignment of the structure where a size is extremely small, as shown in drawing 6 , an edge starts the leg 27 which piezoelectric-device 22a adjoins, and they are the contiguity ink rooms 5, 5, and 5.... There is a possibility of interfering in between. moreover, elastic member 8a which is the oscillating section in adhesives being applied so much partially -- bearing composition -- the danger of being solidified with a member 28 is also high Therefore, in order to join piezoelectric-device 22a and elastic member 8a, it is necessary for this gap to apply necessary minimum adhesives. After applying generally as the adhesion method so that it may not come out of the adhesives of a constant rate with a coating thickness rose to each application section at piezoelectric-device 22a or elastic member 8a, both are held in the state where it contacted and these adhesives are stiffened. Possibility that restrictions on a process will be greatly realized on structure except [this], for example although it is possible to be filled up with the moderate amount [a / elastic member 8/ piezoelectric-device 22a and] according to each gap of piezoelectric-device 22a and elastic member 8a after contact is very small. Then, the method of applying, while managing the adhesives of a constant rate will be taken.
[0024] When the alignment of piezoelectric-device 22a and elastic member 8a is difficult with the structure where a size is extremely small, in the junction state of adhesives, a large state with a rose will be formed like 9a, 9b and 9c of drawing 6 , and .... Here, although three typical types are illustrated, actual much more junction states have arisen. 9a showed the junction state which is not a problem, was stabilized as junction in the dynamic pressure transfer to elastic member 8a from piezoelectric-device 22a, and has hardened it to it. It is because the adhesives on this, i.e., elastic member, 8a or piezoelectric-device 22a are maintained at optimum dose. On the other hand, 9b shows the state where it joined to the leg 27 which the leg 27 which should be joined adjoins. In this state, the regurgitation of the ink from the unnecessary ink room 5 besides the purpose will arise. that 9c is the excess of an adhesives coverage, and nozzle substrate 1a, 3d of cavity formation substrates, elastic member 8a and bearing composition -- the rose and curvature of the thickness direction which are produced by the manufacture process of a member 28 -- the gap of the leg 27 and piezoelectric-device 22a -- narrow -- a bird clapper -- originating -- bearing composition -- the state where the member 28 is also joined is shown this state -- again -- the leg 27 and bearing composition -- piezoelectric-device 22from relation in which member 28 must operate smoothly a -- a variation rate -- in a direction, the two aforementioned member cannot form big ****, therefore it will be easy to incorporate the adhesives B on piezoelectric-device 22a in a wall material 7a row easily like 9c, and expansion and contraction of piezoelectric-device 22a will be prevented therefore -- in order to prevent defluxion of Adhesives B, while changing into a suitable and uniform state the gap of the half nose of cam 50 and the contact side of the leg 27 which piezoelectric-device 22a does not fix -- the leg 27 and bearing composition -- it is important to distinguish between the application height ha grade of adhesives at least with a member 28
[0025] On the other hand, drawing 7 is a fragmentary sectional view explaining the effect by having formed the pars intermedia material 10 carried out by this invention. moreover, the leg 27 and bearing composition -- ****** structure is shown for the cure to friction between members 28 In this drawing, the pars intermedia material 10 is formed by the method of mentioning later, and the state where it was joined to piezoelectric-device 22a is shown. As shown in this drawing, pars intermedia material amends the rose and camber of the thickness direction by the manufacture process of 10d, 10e, nozzle substrate which is .... 10f and was mentioned above 1a, 3d of cavity formation substrates, and elastic member 8b, and as 9d, 9e, and 9f show, it forms the moderate gap. Moreover, the level difference of the height of th pars intermedia material 10 and contiguity wall material 8b is harnessed by the manufacture method mentioned later, it is stabilized and the adhesion stat is formed. Drawing the adhesives B on wall material 8b which adjoins when Adhesives B are moreover applied to up to wall material 8b in piezoelectric-device

22a is lost.
[0026] In addition, besides the above-mentioned example, the pars intermedia material 14 can also be formed in a piezoelectric-device 22 side like drawing 12 . Moreover, like drawing 13 , the pars interm dia material 16 can be formed in a piezoelectric-device 22 side, and the pars intermedia material 15 can also be formed in an elastic member 8 side.
[0027] Next, according to drawing 8 and drawing 9 , the manufacture method of the zygote of an lastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 is described. Drawing 8 and drawing 9 show the cross section seen from [of a piezoelectric device 22] two or more parallel. Although there are methods, such as press working of sheet metal, electrocasting fabrication, and etching, as a manufacturing method of the cavity formation substrate 3, it is a process using the easiest photopolymer film here, and the cavity formation substrate 3 is divided and formed in each of the nozzle substrate 1 and an elastic member 8 at the two sections, and how to weld and make behind to the two sections which carried out division formation is explained. First, drawing 8 is used and the cavity formation by the side of the nozzle substrate 1 of the cavity formation substrate 3 is explained. The photopolymer film (it is called a dry film below) 61 is laminated like the above-mentioned in the nozzle substrate 1 processed by press working of sheet metal or the electroforming method. Next, the glass mask 62 in which the pattern which exposes ultraviolet rays, and the pattern which is not exposed were formed is arranged on the dry film 61 side, and it exposes by irradiating ultraviolet rays. After exposure, the portion hardened by exposure and the unexposed portion which is not exposed are formed on the dry film 61. Next, by developing negatives, an unexposed portion is removed and the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1 is completed.
[0028] A zygote 80 is completed by forming cavity formation substrate 3b on the elastic member 8 into which the elastic member 8 side as well as the aforementioned cavity formation substrate 3a was processed by the electroforming method like drawing 9 on the other hand. And when the completion object of a cavity contacts and welds both of the zygote 80 of the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1, cavity formation substrate 3b, and an elastic member 8 at the temperature of 150-170 degrees C, the cavity formation substrate completion object 90 is manufactured. Although a dry film front face is welded by heat at this time, the amount of crushing of a dry film is determined by welding pressure and time. Moreover, it becomes important, when that pressurization accomplishes equally lessens with [of the amount of crushing of a dry film] a rose. Then, wall material 7b is arranged in the position where cavity formation substrate 3a and cavity formation substrate 3b contact for the purpose of ****** etc., and stabilization with the rose of the amount of crushing of a dry film is attained. Therefore, adjoining ink rooms 5, 5, and 5 .... Wall material 7b is arranged in between, an interval with wall material 7a becomes dense, and a high-density array becomes difficult. Therefore, it becomes important to form the pars intermedia material 10 at the time of junction to a piezoelectric device 22. Moreover, the imbalance of the amount of crushing tends to happen in fact depending on how to allot the existence of the weld meat on a dry film, i.e., a pattern. Moreover, in the cooling process from heating at the time of weld to ordinary temperature, it becomes easy to generate a camber. From the above reason, it is easy to generate with [of thickness h of the cavity formation substrate completion object 90] a rose at the time of manufacture. Therefore, also in with [of a piezoelectric device 22 and an elastic member 8] a gap rose, the pars intermedia material 10 will play an important role.
[0029] Drawing 10 shows the process which forms the aforementioned pars intermedia material 10. 90 is a cavity formation substrate completion object. First, fluid matter 10a which forms the pars intermedia material 10 in the elastic member 8 side of the cavity formation substrate completion object 90 is applied. Priming may be performed to an elastic member 8 for the purpose of the improvement in the adhesion force before an application if needed. Although a photopolymer, thermosetting resin, and a room-temperature-setting nature resin are raised, as for fluid matter 10a, polyester resin, acrylic resin, an epoxy resin, an APR resin, and various resists are used especially. In this example, it can treat comparatively easily and polyester resin (photopolymer) cheap also in cost is used. Next, the PET film aiming at a mold-release

characteristic is laid in the portion which makes a fixed distance estrange from the portion of an elastic member 8 which serves as a convex most and which prepared the gap member (not shown) more than imprint adhesives height ha (drawing 11) to the below-mentioned pars intermedia material 10 top at l ast rather than fluid matter 10a at least at the latus range. Next, the glass mask 91 used as flat criteria is laid on the aforementioned film. The pattern is arranged on this glass mask 91 in order to form the exposure section and the unexposed section alternatively to fluid matter 10a. Furthermore, even if there are few these glass masks, the flatness of about 0.1-0.2 micrometers is made to one side by the side of a film by polish processing. After laying this glass mask 91, it exposes by irradiating ultraviolet rays with the wavelength of about 300-400nm. Since it is hard to expose fluid matter 10a to 400nm or more of visible rays, a dark room and a special facility are unnecessary. After the aforementioned exposure, 2 ****s of fluid matter 10a are carried out, the exposed section causes and hardens a chemical change and the unexposed section is maintaining the fluid state. A portion fluid in the unexposed section is removed in this state. Since fluid matter 10a is easily removable with a weak lye or water, work is safe and harmless. Moreover, a postexposure can also be carried out if needed in order to stiffen a part for a hard spot still more certainly. Moreover, the temperature of 60-80 degrees C may be applied for the purpose of dryness of the component swollen at the time of unexposed section removal. By the above method, the pars intermedia material 10 can be formed and the highly precise pars intermedia material 10 of the same grade as the aforementioned glass mask 91 can be formed about flat-surface precision. In addition, the highly precise pars intermedia material 10 can be similarly formed about the aforementioned thermosetting resin or a room-temperature-setting nature resin also except this example.

[0030] Next, the manufacture method that an adhesion coverage is stabilized and the pars intermedia material 10 and piezoelectric device 22 which were formed on the cavity formation substrate completion object 90 arranged with high density according to drawing 11 can be obtained easily is explained. The flatness grade of a glass mask is made to the flat-surface precision of the pars intermedia material 10 on wall material 7a of the elastic member 8 formed by the aforementioned manufacture method as aforementioned. However, it is about 1-3 micrometers with [with the aforementioned pars intermedia material 10] a gap rose by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix. It is stored with the gap rose in the minimum until now. Then, you have to absorb with a remains rose in the height ha of Adhesives B. Therefore, you have to apply the height ha of Adhesives B uniformly on the pars intermedia material 10 by the grade which is not protruded into a sheet metal 6 from at least 4 micrometers even if many. As the method of an adhesives B constant-rate application, although there are a spin coat, spray printing, octopus printing, a monotonous imprint, and screen-stencil, since the flash to a sheet metal 6 is strict prohibition, with this structure, a spin coat, spray printing, and screen-stencil cannot be used. Moreover, a sheet metal 6 is very as thin as 5 micrometers or less, and in octopus printing, since a pressure is added, it cannot be used, being able to draw destruction of a sheet metal 6. Although one side generally imprints to a transferred object about a monotonous imprint using the plate which has a highly precise flat-surface precision, with this structure, although it is a minute amount about a small amount of adhesives B, it must imprint to the pars intermedia material 10 which has with a flatness rose, and if it takes that the upper pressure cannot be applied into consideration, a monotonous imprint will serve as a method unsuitable for a constant-rate application. Then, to the structure of this invention, the application whose film harnessed the feature which follows with [of flatness] a rose, and managed the imprint height ha with high precision by the film imprint which is one of the decalcomania methods is performed.

[0031] As shown in drawing 11 , the manufacture method is close in the 5 micrometers - 20 micrometers film of a polyimide by this example to the plate which has made about 0.1-0.2 micrometers to one side, manages the height on the film of Adhesives B in the upper part, and it installs the spacer 65 which restricts an area required for an imprint. Adhesives B are dropped at application within the limits of this spacer, an edge has flat nature in a line, and writes the excessive adhesives B to it, and it eliminates with a board. By performing this process of a

series of quickly, adhesives B height of the same grade as spacer ** is obtained. And after eliminating a spacer, the film with which Adhesives B are applied is put on up to the pars intermedia material 10 using the surface tension of Adhesives B. Since the film with which Adhesives B are applied is flexible, it is followed in the shape of [of the cavity formation substrate completion object 90] surface type, and can be drawn near according to the viscosity of Adhesives B. At this time, the film is gradually put on up to the pars intermedia material 10 and wall material 7b so that a foam may not mix in the adhesives B application section. The portion which Adhesives B contacted will obtain the adhesives B imprinted by the uniform height ha, if this film is removed. Since a film imprint follows the configuration of a transferred object irrespective of the flatness of a transferred object, the amount of imprints of Adhesives B is uniformly imprinted also in which imprint portion. A front face is rectangular continuation, and since the pars intermedia material 10 serves as a height, as for this transferred object, the little application of the adhesives B is carried out at the side. Therefore, the adhesives meniscus configuration at the time of junction results to the side of the pars intermedia material 10, and can obtain junction high intensity. The feature of a film imprint is doubling the rigidity of a film, and the kind of film in the shape of [of a transferred object] surface type, choosing them, and choosing what was suitable for the surface area of a transferred object, and the surface state in the principal component of adhesives, and viscosity, and the adhesives application of the parts of the complicated shape of various surface type and surface roughness can carry it out to coating thickness homogeneity easily. As mentioned above, like drawing 7 , by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix, piezoelectric-device 22a is stabilized in the adhesives B of the uniform height ha on the easy pars intermedia material 10 obtained by the method of becoming, without [without it joins to wall material 7b, and] adhesives flowing out to a sheet metal 6, and is joinable to wall material 7a at them.

[0032] The joint structure of the piezoelectric device 22 and elastic member 8 which were formed as stated above can be transmitted to the ink room 5 without loss of the generating force of a piezoelectric device 22. As a feature, the joint structure between a piezoelectric device 22 and an elastic member 8 is in each ink regurgitation equipment not to receive the restraint from from [else] at all. Moreover, the pars intermedia material 10 is a resin, a light thing and by having stabilized the upper adhesives coverage and having formed the pars intermedia material 10, a large margin can be taken to alignment and a piezoelectric device 22 and an elastic member 8 can be joined to contact exactly easily.

[0033]

[Effect of the Invention] As explained above, with the joint structure between the piezoelectric device of the ink regurgitation equipment arranged by being close in parallel, and wall material, rigid-body-ization of an and also [it is based on adhesives defluxion] can be prevented, and the high-density array of ink regurgitation equipment is enabled. Moreover, since between each part material is firmly combined by junction, high-speed responsibility is realizable. Furthermore, since pars intermedia material can manage and form **** with a contiguity member, junction to contiguity wall material can be prevented, the large margin of the alignment to the elastic member of a piezoelectric device can be taken in the direction of a flat surface, and since the load according [a piezoelectric device] to combination to the transection direction of the displacement direction is not added, reliability is acquired. Consequently, the variation rate of a piezoelectric device can be told to an ink room now faithfully and efficiently, and the high-density head by which the ink regurgitation property of having high-speed responsibility was stabilized can be obtained.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram showing the composition of one example of this invention.
[Drawing 2] It is the fragmentary sectional view of an example same as the above.
[Drawing 3] It is the fragmentary sectional view of the field which the example same as the above rotated 90 degrees.
[Drawing 4] It is the partial perspective diagram which looked at the example same as the above from the lower part.
[Drawing 5] It is the plan which looked at the example same as the above from right above.
[Drawing 6] It is a fragmentary sectional view explaining the problem of the conventional example.
[Drawing 7] Book
[Drawing 8] It is drawing showing one process of one example of this invention.
[Drawing 9] It is drawing showing one process of an example same as the above.
[Drawing 10] It is drawing showing one process of an example same as the above.
[Drawing 11] It is a fragmentary sectional view explaining the manufacture method of this invention.
[Drawing 12] It is the fragmentary sectional view of other examples of this invention.
[Drawing 13] It is the fragmentary sectional view of other examples of this invention.
[Description of Notations]
1 1a Nozzle substrate
3 3d Cavity formation substrate
5 Ink Room
6 Sheet Metal
7, 7a, 7b wall material
8 8a Elastic member
9a, 9b, 9c, 9d, 9e, 9f Flow hardening state of adhesives
10, 10d, 10e, 10f, 14, 15, 16 Pars intermedia material
10a Fluid matter
11 Head Frame
12 Installation Hole
21 Standing Ways
22 22a Piezoelectric device
23 Common Board
24 Circuit Pattern
25 Leadframe
27 Leg
28 Bearing Composition -- Member
31 Ink Supply Pipe
32 Ink End Connection
33 Ink Connection Mouth

51 Ink
60 Head Frame Flat Surface
61 Photopolymer Film (Dry Film)
62 Glass Mask
90 Cavity Formation Substrate Completion Object
91 Glass Mask (Basis Jumpei Board)

[Translation done.]

* NOTICES *

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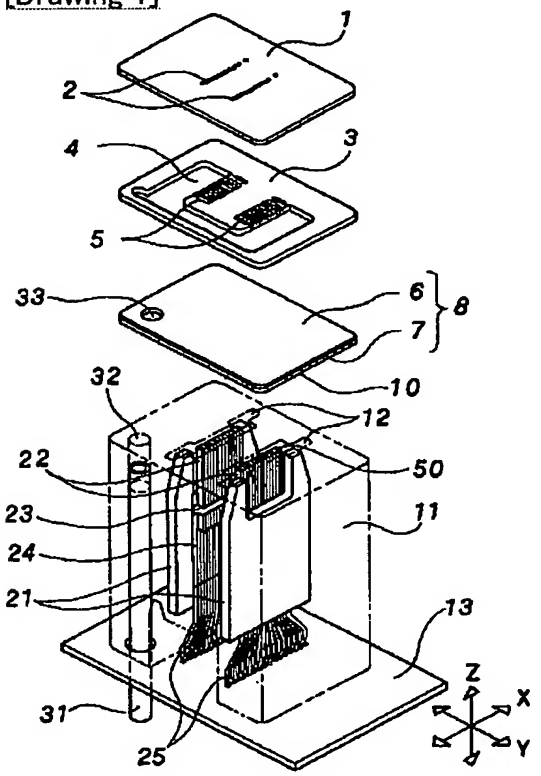
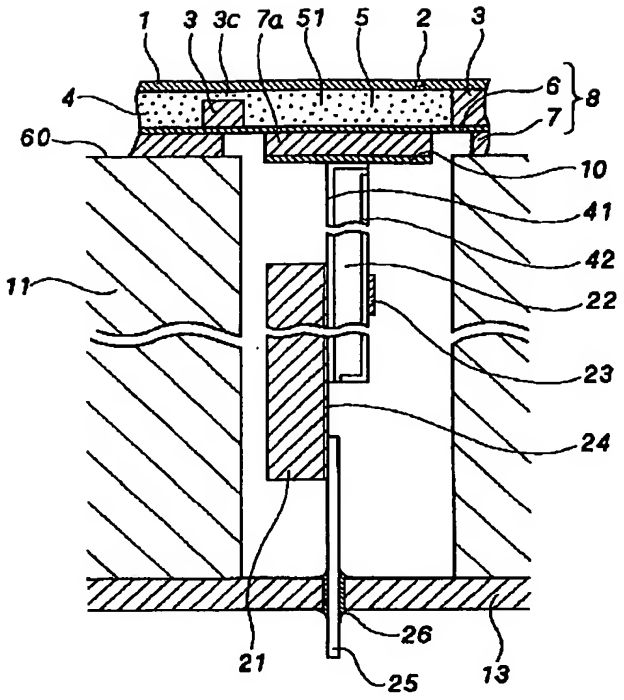
DRAWINGS

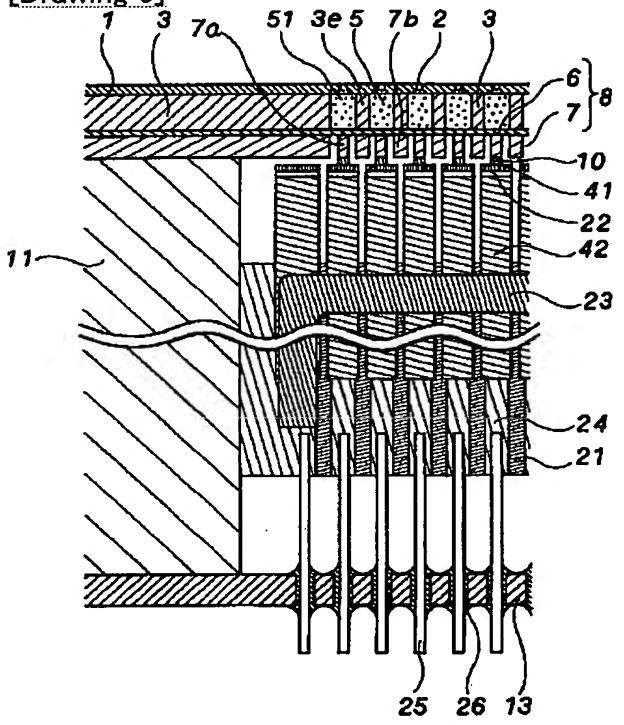
[Drawing 1]



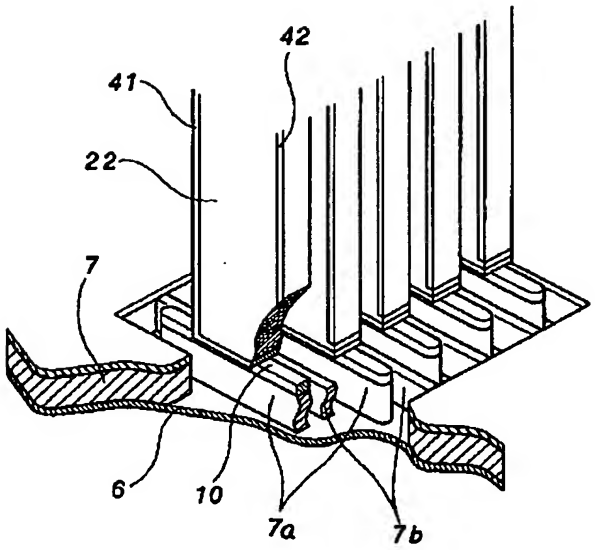
[Drawing 2]



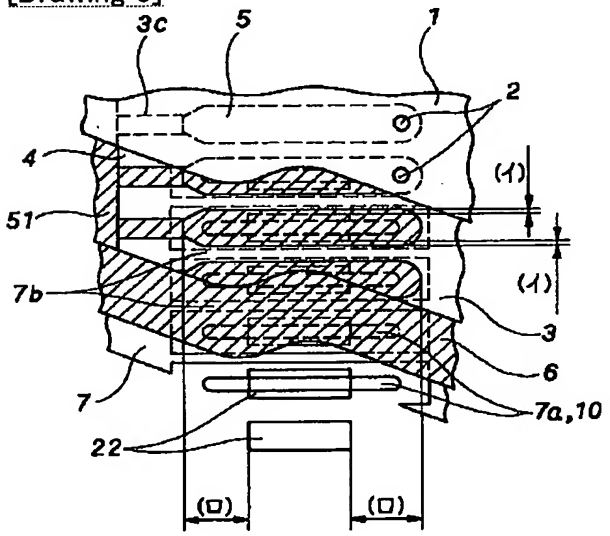
[Drawing 3]



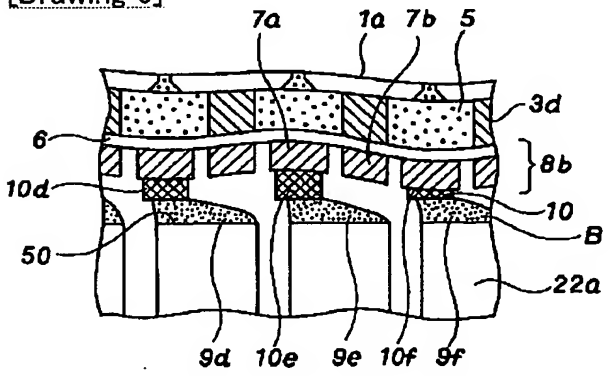
[Drawing 4]



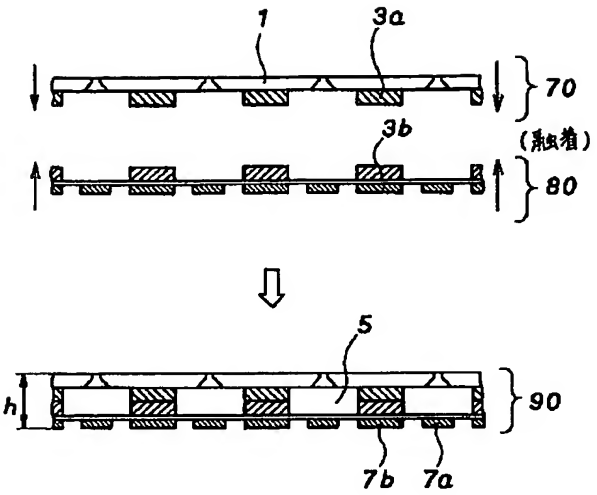
[Drawing 5]



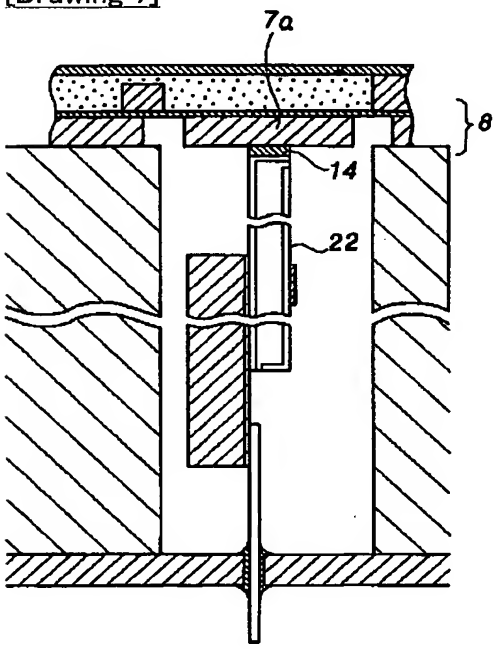
[Drawing 6]



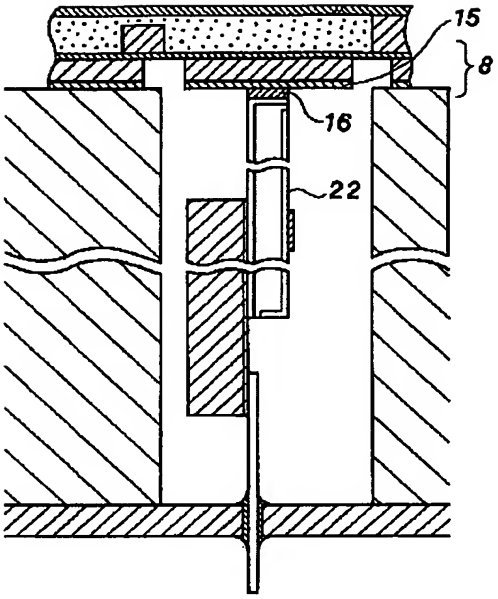
[Drawing 10]



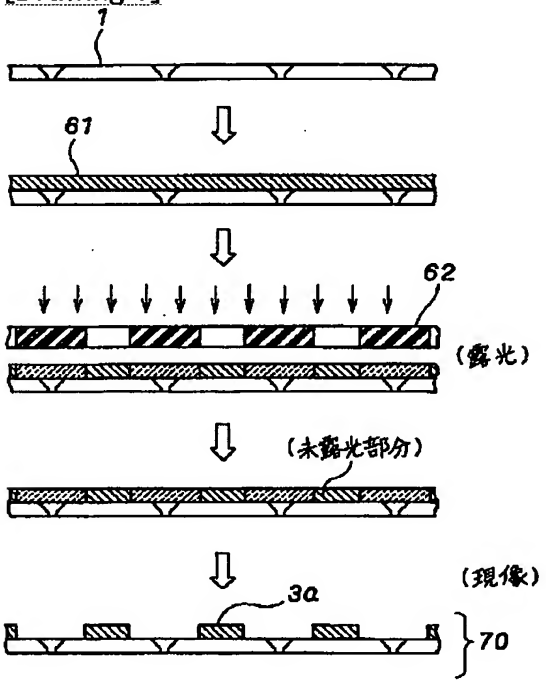
[Drawing 7]



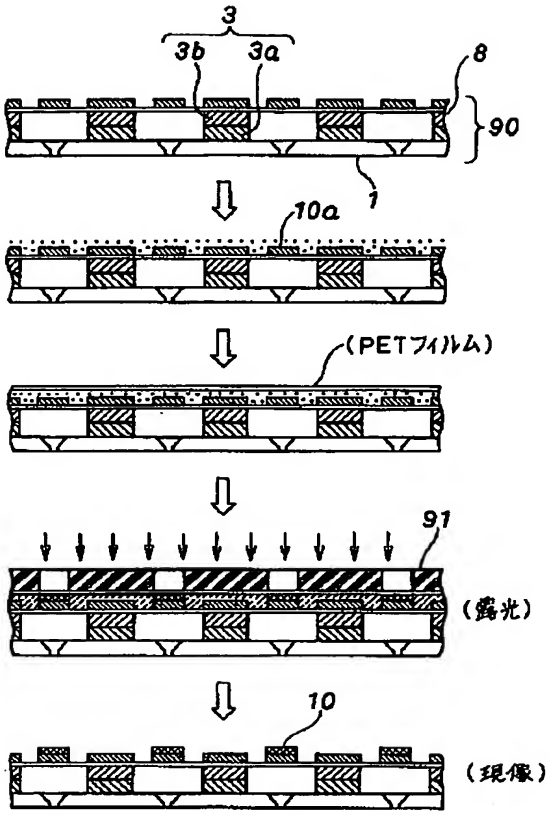
[Drawing 8]



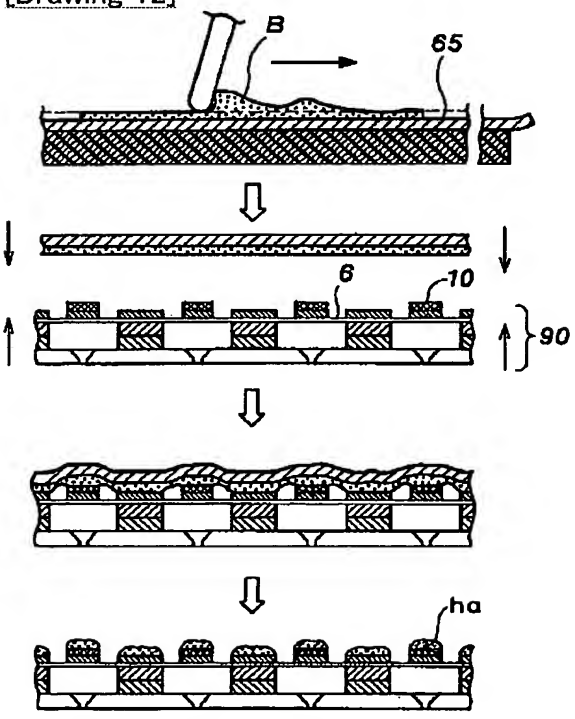
[Drawing 9]



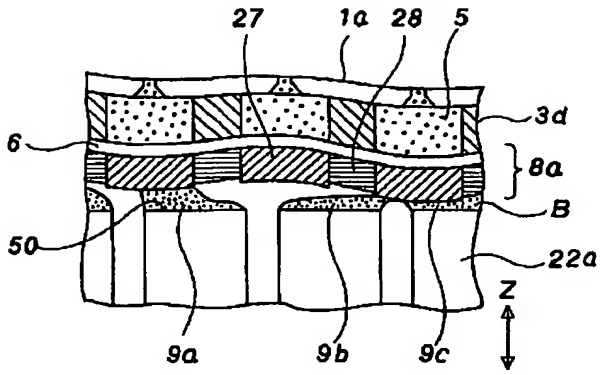
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]

* NOTICES *

CORRECTION or AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law
[Section partition] The 4th partition of the 2nd section
[Date of issue] January 9, Heisei 13 (2001. 1.9)

[Publication No.] JP,5-338159,A
[Date of Publication] December 21, Heisei 5 (1993. 12.21)
[**** format] Open patent official report 5-3382
[Filing Number] Japanese Patent Application No. 4-145778
[The 7th edition of International Patent Classification]

B41J 2/045
2/055
2/16

[FI]

B41J 3/04 103 A
103 H

[Procedure revision]
[Filing Date] June 1, Heisei 11 (1999. 6.1)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Whole sentence
[Method of Amendment] Change
[Proposed Amendment]
[Document Name] Specification
[Title of the Invention] An ink-jet formula print head and its manufacture method
[Claim(s)]
[Claim 1] In the ink-jet formula print head which it has a nozzle, this nozzle, an ink room open for free passage, the elastic member that forms a part of this ink room, and the piezoelectric device combined with this elastic member, and carries out the variation rate of the aforementioned elastic member by the aforementioned piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from the aforementioned nozzle
The ink-jet formula print head characterized by the thing which carry out the aforementioned contact of the variation in the distance of the aforementioned elastic member and the aforementioned piezoelectric device, and which was established for amendment pars intermedia material for every portion at the portion to which the aforementioned piezoelectric device contacts the aforementioned elastic member.
[Claim 2] The width of face of the aforementioned pars intermedia material in the direction of a list of the aforementioned piezoelectric device is an ink-jet formula recording head according to

claim 1 characterized by being narrower than the width of face of the aforementioned elastic member and the aforementioned piezoelectric device, and fixing adhesion.
[Claim 3] The manufacture method of the ink-jet formula print head characterized by applying adhesives in the shape of a thin film, imprinting the thin layer of the aforementioned adhesives in the manufacture method of an ink-jet formula print head according to claim 1 or 2 to the aforementioned elastic member by which junction fixation is carried out, the aforementioned piezoelectric device, or the formed aforementioned pars intermedia material, pressing the aforementioned elastic member and the aforementioned piezoelectric device, and fixing.
[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention breathes out an ink drop according to a printing signal, and relates to the recording head and its manufacture method of the on-demand type ink jet printer which forms an ink image on record media, such as the recording paper.
[0002]
[Description of the Prior Art] As shown in Japanese patent official report Japanese Patent Publication No. No. 45985 [two to], and JP,2-52625,B, the so-called recording head of the on-demand type ink jet printer which makes an ink drop fly according to a printing signal makes the other end of the piezoelectric device by which the end was fixed to the pedestal contact the elastic wall of the container which forms an ink room through the leg, and is constituted. the member which adjoins the member from which this leg constitutes an elastic wall -- translational motion in alignment with the bearing means of inner cylindrical opening is carried out According to the technology of this official report, a piezoelectric device is shrunk, ink room volume is increased, ink room volume is decreased by expanding a piezoelectric device again, and ink is breathed out as a drop from the nozzle. Furthermore, the composition of this technology has taken the structure of carrying out the line contact of the leg to a bearing means, and making it supporting.
[0003]
[Problem(s) to be Solved by the Invention] The size of a piezoelectric device or an ink room becomes small, so that miniaturization of a recording head and densification are attained. the composition of the above-mentioned official report -- a leg member and leg insertion bearing composition -- it is the structure which carries out the laminating of the member of complicated configurations, such as a member, and it is very difficult to manage the size of the miniaturized each part material with high precision, and to manufacture it That is, it has the trouble that it is difficult to acquire the contact state of the leg and the leg insertion bearing composition member which transmit the generating force from a piezoelectric device for required accuracy in two or more ink regurgitation equipments.
[0004] moreover, the leg mutual [of ink regurgitation equipment] in transfer of the generating force from a piezoelectric device, and multiple -- the same leg insertion bearing composition -- a member -- it has the trouble of interfering in order to carry out translational motion inside
[0005] Furthermore, the rigid lowered piezoelectric device which became small [a size] is made included in the regular position, the load to the aforementioned transection direction to a piezoelectric device is added, and the alignment at the time of arranging in a piezoelectric device and the leg the alignment or the engagement means of a piezoelectric device and the piezoelectric device to the leg structure which prevents the lateroduction of the transection direction to the piezoelectric-device major axis of a piezoelectric device by the coupling means of the leg has the trouble of spoiling the reliability of a piezoelectric device.
[0006] It has the trouble that the rigidity of a bond part is low since mechanical coupling means are moreover used between the leg and the elastic wall, and the high-speed responsibility of ink **** is not obtained.
[0007] Then, the overall purpose of this invention is to offer the joint structure where it was improved between the piezoelectric transducer and the elastic wall.
[0008] Other purposes of this invention are to offer the cheap joint method.
[0009] Other purposes of this invention are to offer the joint structure and the joint manufacture method of mass-producing easily.

[0010] It is in other purposes of this invention offering the joint method that a uniform performance can be demonstrated with two or more ink regurgitation equipments with little piezoelectric-device generating force loss.
[0011] Other purposes of this invention are to offer the joint structure which prevents a mutual interference of ink regurgitation equipment.
[0012] Other purposes of this invention are to offer the joint method of having reliability.
[0013] Other purposes of this invention are to offer the joint method which the high-speed responsibility of the ink regurgitation has.
[0014]
[Means for Solving the Problem] The ink room which the ink-jet formula print head of this invention opens for free passage with a nozzle and this nozzle, It has the elastic member which forms a part of this ink room, and the piezoelectric device combined with this elastic member. In the ink-jet formula print head which carries out the variation rate of the elastic member by the piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from a nozzle It is characterized by the thing which contact the portion to which a piezoelectric device contacts an elastic member in the variation in the distance of an elastic member and a piezoelectric device and which was established for amendment pars intermedia material for every portion.
[0015] Moreover, in the starting ink-jet formula print head, the width of face of the pars intermedia material in the direction of a list of a piezoelectric device is narrower than the width of face of an elastic member and a piezoelectric device, and is characterized by fixing adhesion.
[0016] Moreover, in the manufacture method of the starting ink-jet formula print head, adhesives are applied in the shape of a thin film, the thin layer of adhesives is imprinted to the elastic member by which junction fixation is carried out, a piezoelectric device, or the formed pars intermedia material, and it is characterized by pressing an elastic member and a piezoelectric device and fixing.
[0017]
[Example] Drawing 1 is the perspective diagram showing the composition of one example of this invention, and disassembles each part article after assembly. Drawing 2, drawing 3, drawing 4, and drawing 5 show the fragmentary sectional view which drew this example on the detail more, the fragmentary sectional view which rotated the aforementioned fragmentary sectional view of this example 90 degrees, the partial perspective diagram which looked at this example from the lower part, and the part plan which looked at this example from right above, respectively. In addition, drawing 5 shows the state where the component part was penetrated one by one from the top. The fragmentary sectional view drawing 13 explains the conventional trouble to be, and drawing 6 show the fragmentary sectional view explaining the effect in the structure of this invention. Drawing 9 and drawing 10 show the fragmentary sectional view for explaining one example of the manufacture method of an ink room. Drawing 11 shows the fragmentary sectional view for explaining the manufacture method which forms pars intermedia material based on the composition of the example of this invention. Drawing 12 shows the fragmentary sectional view for explaining the manufacture method of this invention based on the example of this invention. Drawing 7 and drawing 8 show the fragmentary sectional view for explaining other examples of this invention.
[0018] In these drawings, 1 is a nozzle substrate. Two or more nozzles 2 are formed in the nozzle substrate 1. 3 is a cavity formation substrate. The cavity formation substrate 3 is pinched by the elastic member 8 used as the nozzle substrate 1 and an elastic wall, and forms a reservoir 4 and the ink room 5. An elastic member 8 accomplishes the laminated structure which consists of a sheet metal 6 and wall material 7. After adhesion junction is carried out one by one and an elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 form a cavity, they form in an elastic member 8 side the pars intermedia material 10 mentioned later, and adhesion junction is carried out on th head frame 11.
[0019] this invention is explained based on drawing 1. The piezoelectric device 22 used as the driving source of the ink drop regurgitation fixed the whole surface of the abbreviation half of the longitudinal direction to standing ways 21, and has joined the nose of cam 50 of the half which

does not fix to the pars intermedia material 10. The flow circuit pattern 24 of a positive electrod and a negative electrode is given to standing ways 21, and the electric field controlled by the control board 13 are given to a piezoelectric device 22 through a leadframe 25. 11 is a head frame. 12 is the installation hole which penetrates the inside of the head frame 11, and supports standing ways 21 to carry out X of a piezoelectric device 22, and alignment (to refer to the XYZ coordinate of drawing 1) of the direction of Y. In addition, the Z direction of a piezoelectric device 22 carries out alignment of the nose of cam 50 of a piezoelectric device 22 in contact with the pars intermedia material 10 after joining the zygote which joined the pars intermedia material 10, the elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 to the head frame 11.

[0020] 31 is an ink supply pipe which supplies ink 51 from an ink reservoir (not shown). Pressing junction of the ink supply pipe 31 is carried out at the head frame 11. Ink passage is open for free passage through the ink end connection 32 in the head frame 11, and the ink connection mouth 33 in an elastic member 8 with the reservoir 4 of the cavity formation substrate 3, and also the ink room 5. The above is outline composition.

[0021] According to drawing 2 and drawing 3, structure is described in more detail. Drawing 2 is a fragmentary sectional view when disconnecting one piezoelectric device of the piezoelectric device 22 which carries out two or more parallel (the direction of X of drawing 1) from a center in the direction of Y of drawing 1. Wall material 7a which the piezoelectric device 22 of an elastic member 8 contacts through the pars intermedia material 10 is aiming at rigid reinforcement to the sheet metal 6 in order to obtain uniformly as much as possible the amount of displacement of the elastic wall of the ink room 5 at a large area, since the ink room cross section is larger than the contact section cross section of a piezoelectric device 22. One electrode 42 of one electrode 41 and others has countered. [piezoelectric device / 22] Electrical connection of the electrode 41 is carried out to the circuit pattern 24 on standing ways 21 simultaneously with junction. Electrical connection of other electrodes 42 is carried out to the circuit pattern 24 on standing ways 21, and the electrode contrary to especially the electrode 41 with the common board 23. The circuit pattern 24 and the control board 13 were connected with the leadframe 25, and the connection place is fixed with solder 26, respectively. In addition, standing ways 21 are in the state to which the piezoelectric device 22 contacted the pars intermedia material 10, and junction fixation is carried out at the head frame 11. That is, alignment of the Z direction of a piezoelectric device 22 is carried out by the pars intermedia material 10. The flat surface 60 of the head frame 11 which contacts the wall material 7 is finished with high precision by meanses, such as flat-surface polish.

[0022] Drawing 3 is a fragmentary sectional view when cutting from a center in the direction of X of drawing 1 of the piezoelectric device 22 arranged in parallel. [two or more] The nozzle substrate 1, the cavity formation substrate 3, and an elastic member 8 are the laminated structures which carried out adhesion junction, in order to carry out adhesion junction, the wall material 7 of an elastic member 8 needs to apply a junction pressure to wall 3e which contacts the nozzle substrate 1 and an elastic member 8 and which separates between an ink room, and wall material 7a which transmits the generating force from a piezoelectric device 22 arranges wall material 7b independently.

[0023] On the other hand, the ink room 5 and reservoir 4 with which it fills up with ink 51 are formed like drawing 5 by the cavity formation substrate 3, the nozzle substrate 1, and the elastic member 8. Although the cavity formation substrate 3 can be made with etching processing of glass, the laminating of a sheet metal, exposure formation of a photopolymer, injection molding of a resin, etc., the photopolymer cheap in cost is used for it by this example. The wrap nozzle substrate 1 consists the upper surface of the cavity formation substrate 3 of a stainless steel plate with which every one nozzl 2 was opened in two or more ink rooms 5, respectively and which is about 0.1mm by press working of sheet metal. The nozzle substrate 1 can be made also by the nickel-electroforming processing method. Moreover, the structure which carried out the laminating of the wall material 7 formed in the thickness of about 10-100 micrometers by the said processing method to the sheet metal 6 by which the wrap elastic member 8 formed the inferior surface of tongue of the cavity formation substrate 3 in the thickness of 5 micrometers

or less by the nickel-electroforming processing method is made. The wall material 7 can acquire a required configuration easily by applying a resist. Although a sheet metal 6 is so desirable that it is thin in order to tell expansion and contraction of a piezoelectric device 22 efficiently to the ink room 5, the ink 51 in the ink room 5 must not ooze out. It is because ink 51 adheres between one electrode 41 of a piezoelectric device 22, and one of other electrodes 42, and to a control board 13 and it short-circuits electrically, when ink 51 presents conductivity. Moreover, resins, such as a film, can also be substituted for a sheet metal 6. Although it will become simple as composition if a piezoelectric device 22 is directly joined to a sheet metal 6, this is not made for the following reasons. The piezoelectric device which adjoins if an electrode 41 contacts a sheet metal 6 as one reason as shown in drawing 2 will connect too hastily. Temporarily, ink 51 will be joined by electric field when an electrode 41 side is used as a common electrode. This leads to ink 51 ionizing with time and causing degradation of reliability. Then, by allotting insulating member, i.e., a photopolymer, to the pars intermedia material 10, it will be released from the above-mentioned problem and the flexibility of the wiring for controlling a piezoelectric device 22 will increase. Another reason has the cross-section configuration of a piezoelectric device 22, and the cross-section configuration of the ink room 5 in differing from a cost side and the reasons of manufacture, as shown in drawing 5. In case a piezoelectric device 22 carries out the pressurization and decompression of the ink room 5, as this is shown in drawing 5, the length (b) of an elastic member 8 which can be displaced is too short, and it cannot fully bend, but it will elapse and the length (b) of an elastic member 8 which can be displaced conversely will absorb the pressure [being long] to generate. Therefore, in order to carry out the pressure transfer of the variation rate of a piezoelectric device 22 efficiently at the ink room 5, the middle transfer member which can secure a length (b) (b) appropriately is needed. Wall material 7a which has rigidity from the reason for the above is needed. Therefore, wall material 7a is designed somewhat smaller than the plane of projection of the ink room 5 so that it may bend as shown in drawing 5, and an amount can be secured. The form which shows wall material 7a in drawing 4 by the electroforming method is made. Moreover, as shown in drawing 6, the pars intermedia material 10 is formed for margin increase of the alignment of the nose of cam 50 of a piezoelectric device 22, and wall material 7a, and, as for the end face of wall material 7a which is an insular part, the nose of cam 50 of a piezoelectric device 22 is joined to this.

[0024] Here, ink drop discharging is explained using drawing 2. According to a printing signal, electric field are impressed to one electrode 41 of a piezoelectric device 22, and one of other electrodes 42 through a leadframe 25 and a circuit pattern 24 from a control board 13. It is going to contract the piezoelectric device 22 to which electric field were impressed to a longitudinal direction (this drawing vertical direction). At this time, the lower half of a piezoelectric device 22 has fixed to the standing ways 21 held at the head frame 11, and cannot carry out contraction displacement. On the other hand, the upper half of a piezoelectric device 22 carries out contraction displacement, without receiving other restraints, and pulls an elastic member 8 through the pars intermedia material 10 with the shrinkage force. The sheet metal 6 of the elastic member 8 pulled by the piezoelectric device 22 through the pars intermedia material 10 bends below, and, as a result, the volume of the ink room 5 expands. If the ink room 5 expands, ink 51 will flow through ink feed-hopper 3c from a reservoir 4. Subsequently, if the electric field of a piezoelectric device 22 are canceled, it will elongate to the original length and a piezoelectric device 22 will compress the ink room 5. ** which breathes out an ink drop from a nozzle 2 by this pressure. Wall material 7a of the pars intermedia material 10 and an elastic member 8 which tells the variation rate of a piezoelectric device 22 to the ink room 5 pressurizes and decompresses the ink room 5 uniformly, leaving the deflection section of a sheet metal 6, since it is somewhat smaller than the plane of projection of the ink room 5, as mentioned above.

[0025] By the way, in the conventional example of joint structure which does not form the pars intermedia material 10 of this invention, two or more ink rooms 5 are close, and the leg 27 is arranged in an one to one. Piezoelectric-device 22a and the leg 27 are joined directly [after / contact], in order to abolish loss at the time of generating force transfer. However, by the alignment of the structure where a size is extremely small, as shown in drawing 13, an edge

starts the leg 27 which piezoelectric-device 22a adjoins, and they are the contiguity ink rooms 5, 5, and 5.... There is a possibility of interfering in between. moreover, elastic member 8a which is the oscillating section in adhesives being applied so much partially -- bearing composition -- the danger of being solidified with a member 28 is also high Therefore, in order to join piezoelectric-device 22a and elastic member 8a, it is necessary for this gap to apply necessary minimum adhesives. After applying generally as the adhesion method so that it may not come out of the adhesives of a constant rate with a coating thickness rose to each application section at piezoelectric-device 22a or elastic member 8a, both are held in the state where it contacted and these adhesives are stiffened. Possibility that restrictions on a process will be greatly realized on structure except [this], for example although it is possible to be filled up with the moderate amount [a / elastic member 8/ piezoelectric-device 22a and] according to each gap of piezoelectric-device 22a and elastic member 8a after contact is very small. Then, the method of applying, while managing the adhesives of a constant rate will be taken.

[0026] When the alignment of piezoelectric-device 22a and elastic member 8a is difficult with the structure where a size is extremely small, in the junction state of adhesives, a large state with a rose will be formed like 9a, 9b and 9c of drawing 13, and .... Here, although three typical types are illustrated, actual much more junction states have arisen. 9a showed the junction state which is not a problem, was stabilized as junction in the dynamic pressure transfer to elastic member 8a from piezoelectric-device 22a, and has hardened it to it. It is because the adhesives on this, i.e., elastic member, 8a or piezoelectric-device 22a are maintained at the proper quantity. On the other hand, 9b shows the state where it joined to the leg 27 which the leg 27 which should be joined adjoins. In this state, **** of the ink from the unnecessary ink room 5 besides the purpose will arise. that 9c is the excess of an adhesives coverage, and nozzle substrate 1a, 3d of cavity formation substrates, elastic member 8a and bearing composition -- the rose and curvature of the thickness direction which are produced by the manufacture process of a member 28 -- the gap of the leg 27 and piezoelectric-device 22a -- narrow -- a bird clapper -- originating -- bearing composition -- the state where the member 28 is also joined is shown this state -- again -- the leg 27 and bearing composition -- piezoelectric-device 22from relation in which member 28 must operate smoothly a -- a variation rate -- in a direction, the two aforementioned member cannot form big ****, therefore it will be easy to incorporate the adhesives B on piezoelectric-device 22a in a wall material 7a row easily like 9c, and expansion and contraction of piezoelectric-device 22a will be prevented therefore -- in order to prevent the outflow of Adhesives B, while changing into a suitable and uniform state the gap of the half nose of cam 50 and the contact side of the leg 27 which piezoelectric-device 22a does not fix -- the leg 27 and bearing composition -- it is important to distinguish between the application height ha grade of adhesives at least with a member 28

[0027] On the other hand, drawing 6 is a fragmentary sectional view explaining the effect by having formed the pars intermedia material 10 carried out by this invention. moreover, the leg 27 and bearing composition -- ****** structure is shown for the cure to friction between members 28 In this drawing, the pars intermedia material 10 is formed by the method of mentioning later, and the state where it was joined to piezoelectric-device 22a is shown. As shown in this drawing, pars intermedia material amends the rose and camber of the thickness direction by the manufacture process of 10d, 10e, nozzle substrate which is .... 10f and was mentioned above 1a, 3d of cavity formation substrates, and elastic member 8b, and as 9d, 9e, and 9f show, it forms the moderate gap. Moreover, the level difference of the height of the pars intermedia material 10 and contiguity wall material 8b is harnessed by the manufacture method mentioned later, it is stabilized and the adhesion state is formed. Drawing the adhesives B on wall material 8b which adjoins when Adhesives B are moreover applied to up to wall material 8b in piezoelectric-device 22a is lost.

[0028] In addition, besides th above-mentioned example, the pars intermedia material 14 can also be formed in a piezoelectric-device 22 side like drawing 7. Moreover, like drawing 8, the pars intermedia material 16 can be formed in a piezoelectric-device 22 side, and the pars intermedia material 15 can also be formed in an elastic member 8 side.

[0029] Next, according to drawing 9 and drawing 10, the manufacture method of the zygote of an

elastic member 8, the cavity formation substrate 3, and the nozzle substrate 1 is described. Drawing 9 and drawing 10 show the cross section seen from [of a piezoel ctric device 22] two or more parallel. Although there are methods, such as press working of sheet metal, electrocasting fabrication, and etching, as a manufacturing method of the cavity formation substrate 3, it is a process using the easiest photopolymer film here, and the cavity formation substrate 3 is divided and formed in each of the nozzle substrate 1 and an elastic member 8 at the two sections, and how to weld and make behind to the two sections which carried out division formation is explained. First, drawing 9 is used and the cavity formation by the side of the nozzle substrate 1 of the cavity formation substrate 3 is explained. The photopolymer film (it is called a dry film below) 61 is laminated like the above-mentioned in the nozzle substrate 1 processed by press working of sheet metal or the electroforming method. Next, the glass mask 62 in which the pattern which exposes ultraviolet rays, and the pattern which is not exposed were formed is arranged on the dry film 61 side, and it exposes by irradiating ultraviolet rays. After exposure, the portion hardened by exposure and the unexposed portion which is not exposed are formed on the dry film 61. Next, by developing negatives, an unexposed portion is removed and the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1 is completed.

[0030] A zygote 80 is completed by forming cavity formation substrate 3b on the elastic member 8 into which the elastic member 8 side as well as the aforementioned cavity formation substrate 3a was processed by the electroforming method like drawing 10 on the other hand. And when the completion object of a cavity contacts and welds both of the zygote 80 of the zygote 70 of cavity formation substrate 3a and the nozzle substrate 1, cavity formation substrate 3b, and an elastic member 8 at the temperature of 150-170 degrees C, the cavity formation substrate completion object 90 is manufactured. Although a dry film front face is welded by heat at this time, the amount of crushing of a dry film is determined by welding pressure and time. Moreover, it becomes important, when that pressurization accomplishes equally lessens with [of the amount of crushing of a dry film] a rose. Then, wall material 7b is arranged in the position where cavity formation substrate 3a and cavity formation substrate 3b contact for the purpose of ****** etc., and stabilization with the rose of the amount of crushing of a dry film is attained. Therefore, adjoining ink rooms 5, 5, and 5 .... Wall material 7b is arranged in between, an interval with wall material 7a becomes dense, and a high-density array becomes difficult. Therefore, it becomes important to form the pars intermedia material 10 at the time of junction to a piezoelectric device 22. Moreover, the imbalance of the amount of crushing tends to happen in fact depending on how to allot the existence of the weld meat on a dry film, i.e., a pattern. Moreover, in the cooling process from heating at the time of weld to ordinary temperature, it becomes easy to generate a camber. From the above reason, it is easy to generate with [of thickness h of the cavity formation substrate completion object 90] a rose at the time of manufacture. Therefore, also in with [of a piezoelectric device 22 and an elastic member 8] a gap rose, the pars intermedia material 10 will play an important role.

[0031] Drawing 11 shows the process which forms the aforementioned pars intermedia material 10. 90 is a cavity formation substrate completion object. First, fluid matter 10a which forms the pars intermedia material 10 in the elastic member 8 side of the cavity formation substrate completion object 90 is applied. Priming may be performed to an elastic member 8 for the purpose of the improvement in the adhesion force before an application if needed. Although a photopolymer, thermosetting resin, and a room-temperature-setting nature resin are raised, as for fluid matter 10a, polyester resin, acrylic resin, an epoxy resin, an APR resin, and various resists are used especially. In this example, it can treat comparatively easily and polyester resin (photopolymer) cheap also in cost is used. Next, the PET film aiming at a mold-release characteristic is laid in the portion which makes a fixed distance estrange from the portion of an elastic member 8 which serves as a convex most and which prepared the gap m mber (not shown) more than imprint adhesives height ha (drawing 12) to the below-mentioned pars intermedia material 10 top at least at the range [at least] larger than fluid matter 10a. Next, the glass mask 91 used as flat criteria is laid on the aforementioned film.

[0032] The pattern is arranged on this glass mask 91 in order to form the exposure section and

the unexposed section alternatively to fluid matt r 10a. Furthermore, ev n if there are few these glass masks, the flatness of about 0.1-0.2 micrometers is made to one side by the side of a film by polish processing. After laying this glass mask 91, it exposes by irradiating ultraviolet rays with the wavelength of about 300-400nm. Since it is hard to expose fluid matter 10a to 400nm or more of visible rays, a dark room and a special facility are unnecessary. After the aforementioned exposure, 2 ****s of fluid matter 10a are carried out, the exposed section causes and hardens a chemical change and the unexposed section is maintaining the fluid state. A portion fluid in the unexposed section is removed in this state. Since fluid matter 10a is easily removable with a weak lye or water, work is safe and harmless. Moreover, a postexposure can also be carried out if needed in order to stiffen a part for a hard spot still more certainly. Moreover, the temperature of 60-80 degrees C may be applied for the purpose of dryness of the component swollen at the time of unexposed section removal. By the above method, the pars intermedia material 10 can be formed and the highly precise pars intermedia material 10 of the same grade as the aforementioned glass mask 91 can be formed about flat-surface precision. In addition, the highly precise pars intermedia material 10 can be similarly formed about the aforementioned thermosetting resin or a room-temperature-setting nature resin also except this example.

[0033] Next, the manufacture method that an adhesion coverage is stabilized and the pars intermedia material 10 and piezoelectric device 22 which were formed on the cavity formation substrate completion object 90 arranged with high density according to drawing 12 can be obtained easily is explained. The flatness grade of a glass mask is made to the flat-surface precision of the pars intermedia material 10 on wall material 7a of the elastic member 8 formed by the aforementioned manufacture method as aforementioned. However, it is about 1-3 micrometers with [with the aforementioned pars intermedia material 10] a gap rose by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix. It is stored with the gap rose in the minimum until now. Then, you have to absorb with a remains rose in the height ha of Adhesives B. Therefore, you have to apply the height ha of Adhesives B uniformly on the pars intermedia material 10 by the grade which is not protruded into a sheet metal 6 from at least 4 micrometers even if many. As the method of an adhesives B constant-rate application, although there are a spin coat, spray printing, octopus printing, a monotonous imprint, and screen-stencil, since the flash to a sheet metal 6 is strict prohibition, with this structure, a spin coat, spray printing, and screen-stencil cannot be used. Moreover, a sheet metal 6 is very as thin as 5 micrometers or less, and in octopus printing, since a pressure is added, it cannot be used, being able to draw destruction of a sheet metal 6. Although one side generally imprints to a transferred object about a monotonous imprint using the plate which has a highly precise flat-surface precision, with this structure, although it is a minute amount about a small amount of adhesives B, it must imprint to the pars intermedia material 10 which has with a flatness rose, and if it takes that the upper pressure cannot be applied into consideration, a monotonous imprint will serve as a method unsuitable for a constant-rate application. Then, to the structure of this invention, the application whose film harnessed the feature which follows with [of flatness] a rose, and managed the imprint height ha with high precision by the film imprint which is one of the decalcomania methods is performed.

[0034] As shown in drawing 12, the manufacture method is close in the 5 micrometers - 20 micrometers film of a polyimide by this example to the plate which has made about 0.1-0.2 micrometers to one side, manages the height on the film of Adhesives B in the upper part, and it installs the spacer 65 which restricts an area required for an imprint. Adhesives B are dropped at application within the limits of this spacer, an edge has flat nature in a line, and writes the excessive adhesives B to it, and it eliminates with a board. By performing this process of a series of quickly, adhesives B height of the same grade as spacer ** is obtained. And after eliminating a spacer, the film with which Adhesives B are applied is put on up to the pars intermedia material 10 using the surface tension of Adhesives B. Since the film with which Adhesives B are applied is flexible, it is followed in the shape of [of the cavity formation substrate completion object 90] surface type, and can be drawn near according to the viscosity

of Adhesives B. At this time, the film is gradually put on up to the pars intermedia material 10 and wall material 7b so that air bubbles may not mix in the adhesives B application section. The portion which Adhesives B contacted will obtain the adhesives B imprinted by the uniform height ha, if this film is removed. Since a film imprint follows the configuration of a transferred object irrespective of the flatness of a transferred object, the amount of imprints of Adhesives B is uniformly imprinted also in which imprint portion. A front face is rectangular continuation, and since the pars intermedia material 10 serves as a height, as for this transferred object, the little application of the adhesives B is carried out at the side. Therefore, the adhesives meniscus configuration at the time of junction results to the side of the pars intermedia material 10, and can obtain junction high intensity. The feature of a film imprint is doubling the rigidity of a film, and the kind of film in the shape of [of a transferred object] surface type, choosing them, and choosing what was suitable for the surface area of a transferred object, and the surface state in the principal component of adhesives, and viscosity, and the adhesives application of the parts of the complicated shape of various surface type and surface roughness can carry it out to coating thickness homogeneity easily. As mentioned above, like drawing 6, by contacting the standing ways of piezoelectric-device 22a, and the nose of cam 50 of the half which does not fix, piezoelectric-device 22a is stabilized in the adhesives B of the uniform height ha on the easy pars intermedia material 10 obtained by the method of becoming, without [without it joins to wall material 7b, and] adhesives flowing out to a sheet metal 6, and is joinable to wall material 7a at them.

[0035] The joint structure of the piezoelectric device 22 and elastic member 8 which were formed as stated above can be transmitted to the ink room 5 without loss of the generating force of a piezoelectric device 22. As a feature, the joint structure between a piezoelectric device 22 and an elastic member 8 is in each ink **** equipment not to receive the restraint from from [else] at all. Moreover, the pars intermedia material 10 is a resin, a light thing and by having stabilized the upper adhesives coverage and having formed the pars intermedia material 10, a large margin can be taken to alignment and a piezoelectric device 22 and an elastic member 8 can be joined to contact exactly easily.

[0036]

[Effect of the Invention] As explained above, it is the ink-jet formula print head of this invention. A nozzle, this nozzle, an ink room open for free passage, and the elastic member that forms a part of this ink room, In the ink-jet formula print head which it has the piezoelectric device combined with this elastic member, and carries out the variation rate of the elastic member by the piezoelectric device, and the ink pressure of the ink interior of a room is heightened [print head], and makes an ink drop breathe out from a nozzle Since **** with a contiguity member is manageable with pars intermedia material by [which contact the portion to which a piezoelectric device contacts an elastic member in the variation in the distance of an elastic member and a piezoelectric device] having prepared amendment pars intermedia material for every portion, Junction to contiguity wall material can be prevented, the large margin of the alignment to the elastic member of a piezoelectric device can be taken in the direction of a flat surface, and reliability is acquired in order not to add the load according [a piezoelectric device] to combination to the crossing direction of the displacement direction. Consequently, the variation rate of a piezoelectric device can be told to an ink room now faithfully and efficiently, and it has the effect that the high-density head by which the ink **** property of having high-speed responsibility was stabilized can be obtained.

[0037] Moreover, the width of face of the pars intermedia material in the direction of a list of a piezoelectric device is narrower than the width of face of an elastic member and a piezoelectric device, in the starting ink-jet formula print head, when adhesion is fixed, it is the joint structure between the piezoelectric device of the ink **** equipment arranged by being close in parallel, and wall material, and can prevent rigid-body-ization of an and also [it is based on an adhesives outflow], and enables the high-density array of ink **** equipment. Moreover, in order to combine between each part material by junction firmly, it has the effect that high-speed responsibility is realizable.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing the composition of one example of this invention.
[Drawing 2] It is the fragmentary sectional view of an example same as the above.
[Drawing 3] It is the fragmentary sectional view of the field which the example same as the above rotated 90 degrees.
[Drawing 4] It is the partial perspective diagram which looked at the example same as the above from the lower part.
[Drawing 5] It is the plan which looked at the example same as the above from right above.
[Drawing 6] Book
[Drawing 7] It is the fragmentary sectional view of other examples of this invention.
[Drawing 8] It is the fragmentary sectional view of other examples of this invention.
[Drawing 9] It is drawing showing one process of one example of this invention.
[Drawing 10] It is drawing showing one process of an example same as the above.
[Drawing 11] It is drawing showing one process of an example same as the above.
[Drawing 12] It is a fragmentary sectional view explaining the manufacture method of this invention.
[Drawing 13] It is a fragmentary sectional view explaining the problem of the conventional example.
[Description of Notations]
1 1a Nozzle substrate
3 3d Cavity formation substrate
5 Ink Room
6 Sheet Metal
7, 7a, 7b wall material
8 8a Elastic member
9a, 9b, 9c, 9d, 9e, 9f Flow hardening state of adhesives
10, 10d, 10e, 10f, 14, 15, 16 Pars intermedia material
10a Fluid matter
11 Head Frame
12 Installation Hole
21 Standing Ways
22 22a Piezoelectric device
23 Common Board
24 Circuit Pattern
25 Leadframe
27 Leg
28 Bearing Composition -- Member
31 Ink Supply Pipe
32 Ink End Connection
33 Ink Connection Mouth
51 Ink
60 Head Frame Flat Surface
61 Photopolymer Film (Dry Film)
62 Glass Mask
90 Cavity Formation Substrate Completion Object
91 Glass Mask (Basis Jumpei Board)

[Translation done.]

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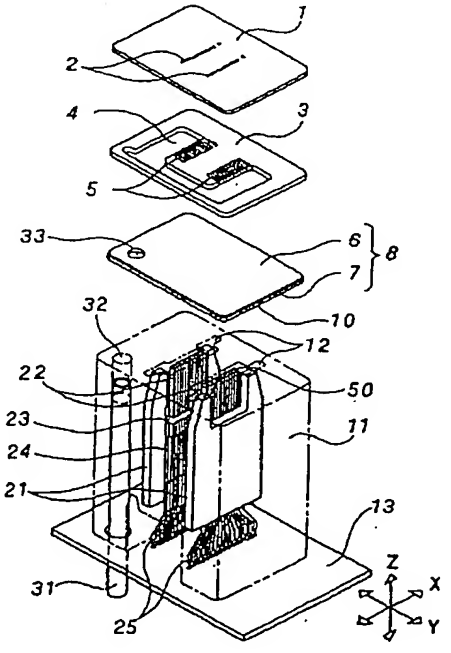
(54)【発明の名称】　インクジェット式印字ヘッド及びその製造方法

(57)【要約】

【目的】　圧電素子２２をより高密度配列するために、圧電素子２２及び弾性部材８より狭い幅で弾性部材８上に中間部材１０を配設することで、隣接壁部材との段差を活かし隣接部材との干渉を防ぎ、位置合わせのマージンを拡大がきる、また複数圧電素子２２の発生力が損失なく安定して弾性部材８へ伝達できる。その上接着剤Ｂを安定して容易に適量管理して塗布を行い、接着剤の流れ出しを防止しを可能にすることを目的とする。

【構成】　インク室５の一部を形成する弾性部材８を圧電素子２２により変位させ、ノズル２からインク滴を吐出させるインクジェットヘッドにおいて、前記弾性部材８と圧電素子２２の間に中間部材１０を設け、中間部材１０を圧電素子２２と接合した構成からなる。



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【特許請求の範囲】

【請求項１】　インク室の一部を形成する弾性部材と、これに一対一に対応、配設される圧電素子とは結合構造をとり、前記弾性部材は前記圧電素子によって変位し、インク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、前記弾性部材と前記圧電素子が当接する部分に中間部材を設け、かつ前記圧電素子複数並列方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、接着により固定されていることを特徴とするインクジェット式印字ヘッド。

【請求項２】　請求項１記載のインクジェット式印字ヘッドにおいて、接着剤を薄膜状に塗布し、前記接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、印字信号に応じてインク滴を吐出して、記録紙等の記録媒体上にインク像を形成するオンデマンド型インクジェット式プリンタの記録ヘッド及びその製造方法に関する。

【０００２】

【従来の技術】印字信号に応じてインク滴を飛翔させる、いわゆるオンデマンド型インクジェット式プリンタの記録ヘッドは、日本特許公報特公平２－４５９８５号や特公平２－５２６２５号に示されたように、一端が基台に固定された圧電素子の他端を、インク室を形成する容器の弾性壁に、脚部を介して当接させて構成される。この脚部は弾性壁を構成する部材に隣接する部材内の円柱形開口の軸受手段に沿った並進運動をしている。同公報の技術によると、圧電素子を収縮させてインク室体積を増大し、再び圧電素子を伸長させることでインク室体積を減少させインクをノズルから液滴として吐出している。更に同技術の構成は、脚部を軸受手段に線接触させて支持させる構造をとっている。

【０００３】

【発明が解決しようとする課題】記録ヘッドの小型化、高密度化を図るほど圧電素子やインク室の寸法は小さくなる。前出の公報の構成では、脚部部材や脚部挿入軸受構成部材等、複雑なる形状の部材を積層する構造であり、小型化した各部材の寸法を高精度に管理し製造することが非常に困難である。つまり圧電素子からの発生力を伝達する脚部と脚部挿入軸受構成部材との接触状態を複数のインク吐出装置において必要精度を得ることが困難であるという問題点を有する。

【０００４】また、圧電素子からの発生力の伝達が、インク吐出装置の相互間で、複数の脚部を同一の脚部挿入軸受構成部材内で並進運動させるために干渉するという

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問題点を有する。

【０００５】更に、圧電素子と脚部の結合手段で、圧電素子の圧電素子長軸に横断方向の側方運動を阻止する脚部構造への圧電素子の位置合わせまたは係合手段を圧電素子と脚部に配設した場合の位置合わせは、寸法の小さくなった、剛性の低下した圧電素子を定位置へ組み込ませることとなり、圧電素子への前記横断方向への負荷が加わり、圧電素子の信頼性を損なうという問題点を有する。

【０００６】その上、脚部と弾性壁間に機械的結合手段を用いているため結合部の剛性が低く、インク吐出の高速応答性が得られないという問題点を有する。

【０００７】そこで、本発明の全体的な目的は、圧電変換器と弾性壁との間の改良された結合構造を提供することにある。

【０００８】本発明の他の目的は安価な結合方法を提供することにある。

【０００９】本発明の他の目的は容易に量産できる結合構造かつ結合製造方法を提供することにある。

【００１０】本発明の他の目的は圧電素子発生力損失の少ない、複数のインク吐出装置で均一なる性能の発揮できる結合方法を提供することにある。

【００１１】本発明の他の目的はインク吐出装置の相互間の干渉を防ぐ結合構造を提供することにある。

【００１２】本発明の他の目的は信頼性を有する結合方法を提供することにある。

【００１３】本発明の他の目的はインク吐出の高速応答性の有する結合方法を提供することにある。

【００１４】

【課題を解決するための手段】本発明のインクジェット式印字ヘッドは、インク室の一部を形成する弾性部材と、これに一対一に対応、配設される圧電素子とは結合構造をとり、前記弾性部材は前記圧電素子によって変位され、インク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、前記弾性部材と前記圧電素子との少なくとも一方に、前記弾性部材と前記圧電素子とが当接する部分に中間部材を設け、かつ前記圧電素子複数並列方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、各部材は接着により固定されていることを特徴とする。更に、その製造方法においては、接着剤を薄膜に塗布し、前記薄膜上に塗布された接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。

【００１５】

【実施例】図１は本発明の一実施例の構成を示す斜視図であり、組立後に各部品を分解したものである。図２、図３、図４、図５はそれぞれ、同実施例をより詳細に描

いた部分断面図、同実施例の前記部分断面図を９０度回転した部分断面図、同実施例を下方より見た部分斜視図、同実施例を真上より見た部分平面図を示す。尚、図５は構成部品を上より順次透過した状態を示す。図６は従来の問題点を説明する部分断面図、図７は本発明の構造での効果を説明する部分断面図を示す。図８、図９はインク室の製造方法の一実施例を説明するための部分断面図を示す。図１０は本発明の実施例の構成に基づいて、中間部材を形成する製造方法を説明するための部分断面図を示す。図１１は本発明の実施例に基づいて、本発明の製造方法を説明するための部分断面図を示す。図１２、図１３は本発明の他の実施例を説明するための部分断面図を示す。

【００１６】これらの図において、１はノズル基板である。ノズル基板１には、複数のノズル２を設けてある。３はキャビティ形成基板である。キャビティ形成基板３は、ノズル基板１と、弾性壁となる弾性部材８とで挟まれて、リザーバ４とインク室５を形成する。弾性部材８は、金属薄板６と壁部材７とからなる積層構造を成す。弾性部材８、キャビティ形成基板３、ノズル基板１は順次密着接合されキャビティを形成した後、後述する中間部材１０を弾性部材８側に形成し、ヘッドフレーム１１上に密着接合されている。

【００１７】図１をもとに本発明を説明する。インク滴吐出の駆動源となる圧電素子２２は、その長手方向の約半分の一面を固定台２１に固着され、固着されない半分の先端５０を中間部材１０と接合している。固定台２１には正極と負極の導通配線パターン２４が施され、リードフレーム２５を介して、制御基板１３により制御された電界を圧電素子２２に与える。１１はヘッドフレームである。１２はヘッドフレーム１１内を貫通する取り付け穴で、圧電素子２２のX，Y方向の位置合わせ（図１のＸＹＺ座標参照）をするべく固定台２１を支持する。尚、圧電素子２２のZ方向は、中間部材１０と弾性部材８とキャビティ形成基板３とノズル基板１を接合した接合体を、ヘッドフレーム１１に接合後、圧電素子２２の先端５０を中間部材１０に当接して位置合わせする。

【００１８】３１はインク溜部（図示せず）からインク５１を供給するインク供給管である。インク供給管３１は、ヘッドフレーム１１に圧入接合されている。インク流路は、ヘッドフレーム１１にあるインク接続口３２と弾性部材８にあるインク連絡口３３を経て、キャビティ形成基板３のリザーバ４、更にインク室５と連通している。以上が概略構成である。

【００１９】図２、図３に従って、構造について更に詳しく述べる。図２は複数並列（図１のX方向）する圧電素子２２の、一本の圧電素子を図１のＹ方向へ中央より切断したときの部分断面図である。弾性部材８の圧電素子２２が中間部材１０を介して当接する壁部材７ａは、圧電素子２２の当接部断面積よりインク室断面積が大きいために、インク室５の弾性壁の変位量を可能な限り大面積で均一に得るため、金属薄板６に対して剛性の補強を図っている。圧電素子２２は、一方の電極４１と他の一方の電極４２が対向している。電極４１は、固定台２１上の配線パターン２４に接合と同時に電気接続されている。他の電極４２は、共通板２３により、固定台２１上の配線パターン２４、特に電極４１に反する電極と電気接続している。配線パターン２４と制御基板１３とをリードフレーム２５で結び、それぞれ接続箇所を半田２６で固着している。尚、固定台２１は、圧電素子２２が中間部材１０に当接した状態で、ヘッドフレーム１１に接合固定されている。つまり、圧電素子２２のZ方向は中間部材１０で位置合わせする。壁部材７と当接するヘッドフレーム１１の平面６０は、平面研磨等の手段により高精度に仕上げられている。

【００２０】図３は複数並列する圧電素子２２の図１のX方向へ中央より切断したときの部分断面図である。ノズル基板１とキャビティ形成基板３と弾性部材８とは密着接合した積層構造であり、密着接合させるために、弾性部材８の壁部材７はノズル基板１と弾性部材８とに当接する、インク室間を隔てる壁３ｅに接合圧力を加えることが必要であり、圧電素子２２からの発生力を伝達する壁部材７ａとは別に壁部材７ｂを配設する。

【００２１】一方、図５のごとくインク５１が充填されるインク室５及びリザーバ４は、キャビティ形成基板３とノズル基板１と弾性部材８とで形成される。キャビティ形成基板３は、ガラスのエッチング加工、金属薄板の積層、感光性樹脂の露光形成、樹脂の射出成形等で作ることができるが、本実施例では、コスト的に安価な感光性樹脂を用いている。キャビティ形成基板３の上面を覆うノズル基板１は、プレス加工によって、複数のインク室５にそれぞれ一つずつノズル２が開けられた、０．１ｍｍ程のステンレス鋼板からなる。ノズル基板１は、ニッケルの電鋳加工法によっても作ることができる。また、キャビティ形成基板３の下面を覆う弾性部材８は、ニッケルの電鋳加工法で５μｍ以下の厚さに形成した金属薄板６に、同加工法で１０～１００μｍ程度の厚さに形成した壁部材７を積層した構造をなす。壁部材７は、レジストを塗布することで容易に必要なる形状を得ることが出来る。金属薄板６は、圧電素子２２の伸縮をインク室５に効率良く伝えるために薄いほど好ましいが、インク室５内のインク５１がしみ出してはならない。インク５１が導電性を呈する場合、圧電素子２２の一方の電極４１と他の一方の電極４２間や制御基板１３にインク５１が付着して、電気的にショートしてしまうからである。また、金属薄板６をフィルム等の樹脂で代替することもできる。圧電素子２２を金属薄板６に直接接合すれば構成としては簡素になるが、以下の理由によりこれができない。一つの理由として、図２に示すように、電極４１が金属薄板６と接触すると隣接する圧電素子が短絡

してしまう。仮に、電極４１側を共通電極とした場合には、インク５１に電界が加わることになる。このことは、インク５１が経時的にイオン化して、信頼性の劣化を招くことにつながる。そこで、中間部材１０に絶縁部材即ち感光性樹脂を配することにより上記の問題から解放され、圧電素子２２を制御するための配線の自由度が増すことになる。もう一つの理由は、図５に示すように、圧電素子２２の断面形状とインク室５の断面形状が、コスト面及び製造上の理由から異なることにある。このことは、圧電素子２２がインク室５を加減圧する際、図５に示すように、変位できる弾性部材８の長さ（イ）が短すぎて充分にたわむことができず、逆に変位できる弾性部材８の長さ（ロ）は長すぎて発生する圧力を吸収してしまう。よって、圧電素子２２の変位を効率良くインク室５に圧力伝達するために、長さ（イ）（ロ）を適切に確保できる中間伝達部材が必要となる。上記理由から剛性を有する壁部材７ａが必要とされる。従って、壁部材７ａは、図５に示すようにたわみ量が確保できるように、インク室５の投影面より一回り小さく設計されている。壁部材７ａは、電鋳加工法によって図４に示す形が作られる。また、図７に示されるように、島状部である壁部材７ａの端面は、圧電素子２２の先端５０と壁部材７ａとの位置合わせのマージン増大のため中間部材１０が形成され、これに圧電素子２２の先端５０が接合されている。

【００２２】ここで、インク滴吐出動作を図２を用いて説明する。印字信号に応じて制御基板１３からリードフレーム２５、配線パターン２４を通じて圧電素子２２の一方の電極４１と他の一方の電極４２とに電界を印加する。電界を印加された圧電素子２２は長手方向（同図上下方向）に収縮しようとする。この時、圧電素子２２の下半分は、ヘッドフレーム１１に保持される固定台２１に固着されており、収縮変位できない。一方、圧電素子２２の上半分は、他の拘束を受けることなく収縮変位して、その収縮力により中間部材１０を介して弾性部材８を引張る。中間部材１０を介して圧電素子２２に引張られた弾性部材８の金属薄板６が下方へたわみ、その結果インク室５の体積が膨張する。インク室５が膨張すると、リザーバ４からインク供給口３ｃを通じてインク５１が流入する。次いで、圧電素子２２の電界を解除すると、圧電素子２２は元の長さに伸長してインク室５を圧縮する。この圧力でノズル２からインク滴を吐出する。圧電素子２２の変位をインク室５に伝える中間部材１０と弾性部材８の壁部材７ａは前述したように、インク室５の投影面より一回り小さいため、金属薄板６のたわみ部を残しつつインク室５をまんべんなく加圧及び減圧する。

【００２３】ところで、本発明の中間部材１０を形成しない従来の結合構造例では、複数のインク室５が密接し、一対一に脚部２７を配設する。圧電素子２２ａと脚部２７は、発生力伝達時損失をなくすため当接後直接接合する。しかし、寸法が極端に小さな構造の位置合わせで、図６に示すごとく圧電素子２２ａが隣接する脚部２７に端部が掛かり、隣接インク室５、５、５‥‥間で干渉する恐れがある。また、接着剤が部分的に多量に塗布されることで振動部である弾性部材８ａが軸受構成部材２８と共に固化されてしまう危険性も高い。従って、この間隙には、圧電素子２２ａと弾性部材８ａとを接合するために必要最小限の接着剤を塗布することが必要となる。接着方法としては、一般に一定量の接着剤を圧電素子２２ａまたは弾性部材８ａに、各塗布部に塗布厚バラつきがでないように塗布した後、両者を当接した状態で保持し同接着剤を硬化させている。これ以外では、例えば、圧電素子２２ａと弾性部材８ａとを当接後、圧電素子２２ａと弾性部材８ａとの各間隙に応じた適度な量を充填することが考えられるが、構造上、製法上制約が大きく実現する可能性は極めて小さい。そこで、一定量の接着剤を管理しながら塗布する方法を採ることとなる。

【００２４】圧電素子２２ａと弾性部材８ａとの位置合わせが寸法が極端に小さな構造で困難である場合、接着剤の接合状態において図６の９ａ、９ｂ、９ｃ、‥‥のごとく、バラつきの大きい状態が形成されることとなる。ここでは、代表的な３タイプを図示しているが、実際にはもっと多くの接合状態が生じている。９ａは、圧電素子２２ａから弾性部材８ａへの動圧伝達には問題無い接合状態を示し、接合としては安定して硬化している。これは、即ち弾性部材８ａあるいは圧電素子２２ａ上の接着剤が適量に保たれているからである。一方、９ｂは接合するべき脚部２７の隣接する脚部２７へ接合した状態を示す。この状態においては、目的外の不必要なインク室５からのインクの吐出が生ずることとなる。９ｃは接着剤塗布量の過剰であることと、ノズル基板１ａ、キャビティ形成基板３ｄ、弾性部材８ａ、軸受構成部材２８の製造過程により生ずる厚み方向のバラつきや反りにより脚部２７と圧電素子２２ａとの間隙が狭くなることが起因して、軸受構成部材２８をも接合している状態を示す。この状態はまた、脚部２７と軸受構成部材２８とは滑らかに動作しなければならない関係から、圧電素子２２ａ変位方向において前記二部材は大きな断差を形成することができなく、従って壁部材７ａならびに圧電素子２２ａ上の接着剤Ｂを９ｃのように容易に取り込み易く、圧電素子２２ａの伸縮が阻止されることとなる。よって、接着剤Ｂの流出を防ぐために圧電素子２２ａの固着されない半分の先端５０と脚部２７の当接面との間隙を適切で均一な状態にすると共に、脚部２７と軸受構成部材２８と少なくとも接着剤の塗布高さｈａ程度に段差をつけることが重要である。

【００２５】一方図７は、本発明で実施される中間部材１０を設けたことによる効果を説明する部分断面図である。また、脚部２７と軸受構成部材２８間の摩擦に対し

対策を講じた構造を示している。同図において、後述する方法で中間部材１０を形成し、圧電素子２２ａと接合された状態を示す。中間部材は同図のごとく、１０ｄ、１０ｅ、１０ｆ‥‥で、前述したノズル基板１ａ、キャビティ形成基板３ｄ、弾性部材８ｂの製造過程による厚み方向のバラつきやソリを補正し、９ｄ、９ｅ、９ｆで示すように、適度な間隙を形成している。また、後述する製造方法により中間部材１０の高さと隣接壁部材８ｂとの段差を活かし接着状態を安定して形成している。その上、壁部材８ｂ上へ接着剤Ｂを塗布した場合においても隣接する壁部材８ｂ上の接着剤Ｂを圧電素子２２ａに引き込むことがなくなる。

【００２６】その他前述の実施例以外にも、例えば図１２のように、圧電素子２２側に中間部材１４を形成することもできる。また、図１３のように、圧電素子２２側に中間部材１６を形成し、弾性部材８側に中間部材１５を形成することもできる。

【００２７】次に図８、図９に従って弾性部材８とキャビティ形成基板３とノズル基板１との接合体の製造方法について述べる。図８、図９は圧電素子２２の複数並列方向から見た断面を示すものである。キャビティ形成基板３の製造法としてはプレス加工、電鋳成形、エッチング等の方法があるが、ここでは最も容易なる感光性樹脂フィルムを用いた製法で、ノズル基板１と弾性部材８の各々へキャビティ形成基板３を２部に分割して形成し、後に分割形成した２部を融着して仕上げる方法について説明する。最初に、図８を用いキャビティ形成基板３のノズル基板１側のキャビティ形成について説明する。前述のごとくプレス加工または電鋳加工法によって加工されたノズル基板１に感光性樹脂フィルム（以下ドライフィルムと呼ぶ）６１をラミネートする。次に紫外線を露光するパターンと露光しないパターンを形成したガラスマスク６２をドライフィルム６１側に配し、紫外線を照射し露光を行う。露光後には、ドライフィルム６１上に、露光によって硬化した部分と露光されない未露光部分が形成される。次に、現像を行うことによって未露光部分を除去し、キャビティ形成基板３ａとノズル基板１の接合体７０が完成する。

【００２８】一方、図９のように弾性部材８側も前記キャビティ形成基板３ａと同様にして電鋳加工法によって加工された弾性部材８上にキャビティ形成基板３ｂを形成することで接合体８０が完成する。そして、キャビティの完成体は、キャビティ形成基板３ａとノズル基板１との接合体７０とキャビティ形成基板３ｂと弾性部材８との接合体８０の両者を当接し、１５０～１７０℃の温度で融着することによって、キャビティ形成基板完成体９０が製造される。この時、ドライフィルム表面は熱によって融着されるが、加圧力と時間によってドライフィルムのつぶれ量が決定される。また、加圧が均等に成されることがドライフィルムのつぶれ量のバラつきを少なくする上で重要となる。そこで加圧均等を目的に、キャビティ形成基板３ａとキャビティ形成基板３ｂとが当接する位置には、壁部材７ｂを配設してドライフィルムのつぶれ量のバラつきの安定化を図っている。そのため、隣接するインク室５、５、５‥‥間に壁部材７ｂが配設され、壁部材７ａとの間隔が密となり高密度配列が困難となる。よって、圧電素子２２との接合時に中間部材１０を設けることが重要になる。また、実際には、ドライフィルム上における融着肉の有無即ちパターンの配し方によって、つぶれ量のアンバランスが起こり易い。また、融着時の加熱から常温への冷却過程では、ソリが発生しやすくなる。以上の理由から、製造時にキャビティ形成基板完成体９０の厚みｈのバラつきが発生しやすくなっている。従って、圧電素子２２と弾性部材８との間隙バラつきにおいても中間部材１０は重要な役割を果たすこととなる。

【００２９】図１０は、前記中間部材１０を形成する過程を示す。９０は、キャビティ形成基板完成体である。まず、キャビティ形成基板完成体９０の弾性部材８側に、中間部材１０を形成する流動性物質１０ａを塗布する。必要に応じて、塗布前に密着力向上を目的として、弾性部材８にプライマー処理を施すこともある。流動性物質１０ａは、感光性樹脂、熱硬化性樹脂、常温硬化性樹脂があげられるが、特にポリエステル樹脂、アクリル樹脂、エポキシ樹脂、ＡＰＲ樹脂、各種レジストが使用される。本実施例では、比較的簡単に扱えコスト的にも安価なポリエステル樹脂（感光性樹脂）を用いている。次に、弾性部材８の最も凸となる部分から、一定の距離を離間せしめる、少なくとも後述の中間部材１０上への転写接着剤高さｈａ（図１１）以上の、間隙部材（図示せず）を設けた部分に、離型性を目的としたＰＥＴフィルムを、少なくとも流動性物質１０ａよりも広い範囲に載置する。次に、前記フィルム上に平坦の基準となるガラスマスク９１を載置する。このガラスマスク９１には、流動性物質１０ａに対して露光部と未露光部を選択的に形成する目的で、パターンが配されている。更に、このガラスマスクの少なくともフィルム側の片面は、研磨加工で平面度０．１～０．２μｍ程度に仕上げられている。このガラスマスク９１を載置した後、３００～４００nm程度の波長を持つ紫外線を照射することによって、露光を行う。流動性物質１０ａは、可視光線４００nm以上には感光しにくいので、暗室や特別な設備は必要ない。前記露光後には、流動性物質１０ａは２分化され、被露光部は化学変化を起こして硬化し未露光部は流動性の状態を保っている。この状態で、未露光部で流動性の部分の除去を行う。流動性物質１０ａは、弱アルカリ液あるいは水で簡単に除去できるので、作業は安全且つ無害である。また、硬化部分を更に確実に硬化させる目的で、後露光を必要に応じて実施することもできる。その上、未露光部除去時に膨潤した成分の乾燥を目的に

６０～８０℃の温度を加えることもある。以上の方法により、中間部材１０を形成することができ、平面精度については前記ガラスマスク９１と同程度な高精度の中間部材１０を形成することができる。尚、本実施例以外でも、前記熱硬化性樹脂や常温硬化性樹脂についても、同様に高精度な中間部材１０を形成することができる。

【００３０】次に図１１に従って高密度に配設したキャビティ形成基板完成体９０上に形成された中間部材１０と圧電素子２２とを、接着塗布量を安定して容易に得ることのできる製造方法について説明する。前記製造方法により形成した弾性部材８の壁部材７ａ上の中間部材１０の平面精度は、前記の通りガラスマスクの平面度程度には仕上げられている。しかし、圧電素子２２ａの固定台と固着されない半分の先端５０と当接することで前記中間部材１０との間隙バラつきが１～３μｍ程度はある。これまでに間隙バラつきは最小限に収められている。そこで、残留バラつきは接着剤Ｂの高さｈａで吸収しなければならない。従って、少なくとも４μｍから、多くても金属薄板６へはみ出さない程度で、接着剤Ｂの高さｈａを中間部材１０上に均一に塗布しなければならない。接着剤Ｂ一定量塗布の方法としては、スピンコート、スプレー印刷、タコ印刷、平板転写、スクリーン印刷があるが、本構造では金属薄板６へのはみ出しが厳禁であるためスピンコート、スプレー印刷、スクリーン印刷は使用できない。また、金属薄板６が５μｍ以下と非常に薄く、タコ印刷では圧力が加わるため金属薄板６の破壊を導き使用できない。平板転写については、一般的に片面が高精度な平面精度を有する平板を用い被転写物へ転写するが、本構造では少量の接着剤Ｂを微量ではあるが平面度バラつきをもつ中間部材１０へと転写しなければならなく、その上圧力を加えられないことを考慮すると、平板転写は一定量塗布にとって不適切な方法となる。そこで、本発明の構造に対しては転写印刷法の一つであるフィルム転写により、フィルムが平面度のバラつきに追従する特徴を活かし高精度に転写高さｈａを管理した塗布を行なう。

【００３１】製造方法は、図１１に示すように片面を０．１～０．２μｍ程度に仕上げてある平板へ、本実施例ではポリイミドの５μｍ～２０μｍのフィルムを密接し、上部に接着剤Ｂのフィルム上での高さを管理し、転写に必要な面積を制限するスペーサー６５を設置する。このスペーサーの塗布範囲内に接着剤Ｂを滴下し、余分な接着剤Ｂを端部が線状に平坦性を有するかき取り板で排除する。この一連の工程を迅速に行うことで、スペーサー厚と同程度の接着剤Ｂ高さを得る。そして、スペーサーを排除した後、接着剤Ｂの塗布されているフィルムを中間部材１０上へ接着剤Ｂの表面張力を利用して置く。接着剤Ｂの塗布されているフィルムは柔軟であるためキャビティ形成基板完成体９０の表面形状に追従して接着剤Ｂの粘性により引き寄せられる。この時、接着剤Ｂ塗布部に気泡が混入しないように徐々にフィルムを中間部材１０及び壁部材７ｂ上へと置いていく。接着剤Ｂの当接した部分は、このフィルムを除去すると、均一高さｈａに転写された接着剤Ｂを得る。フィルム転写は、被転写物の平面度に拘らず被転写物の形状に追従するため、接着剤Ｂの転写量はいずれの転写部分においても均一に転写される。本被転写物は、表面が矩形の連続であり、中間部材１０が高所となっているため接着剤Ｂがその側面に少量塗布される。従って接合時の接着剤メニスカス形状が中間部材１０の側面まで至り接合高強度を得ることができる。フィルム転写の特徴は、フィルムの剛性やフィルムの種類を被転写物の表面形状に合わせ選択し、接着剤の主成分、粘度を被転写物の表面積、表面状態に適したものを選択することで、様々な複雑なる表面形状、表面粗さの部品の接着剤塗布が塗布厚均一に容易に行える。以上のように容易なる方法で得られた中間部材１０上の均一高さｈａの接着剤Ｂに、図７のように圧電素子２２ａの固定台と固着されない半分の先端５０と当接することで、圧電素子２２ａは壁部材７ｂと接合することなく、また金属薄板６へ接着剤が流出することなく安定して壁部材７ａと接合することができる。

【００３２】以上述べたごとく形成した圧電素子２２と弾性部材８との結合構造は、圧電素子２２の発生力を損失無くインク室５へ伝達できるものである。特徴としては、個々のインク吐出装置において、圧電素子２２と弾性部材８間の結合構造は他からの拘束を全く受けないことにある。また中間部材１０が樹脂であり軽いこと、その上接着剤塗布量が安定し中間部材１０を設けていることにより位置合わせにマージンが広く取れ、容易に的確に当接するべく圧電素子２２と弾性部材８とを接合できる。

【００３３】

【発明の効果】以上説明したように、並列に密接して配設されるインク吐出装置の圧電素子と壁部材間の結合構造で、接着剤流出による他との剛体化を防ぐことが出来、インク吐出装置の高密度配列を可能にする。また、各部材間を強固に接合により結合させるため高速応答性を実現できる。更に、中間部材が隣接部材との断差を管理して形成できるため、隣接壁部材との接合を防ぐことができ、平面方向で圧電素子の弾性部材に対する位置合わせのマージンを広くとることができ、圧電素子はその変位方向の横断方向に結合による負荷が加わらないため信頼性が得られる。その結果、圧電素子の変位を忠実且つ効率良くインク室に伝えることができるようになり、高速応答性を有するインク吐出特性の安定した高密度ヘッドを得ることができる。

【図面の簡単な説明】

【図１】本発明の１実施例の構成を示す斜視図である。

【図２】同上実施例の部分断面図である。

【図３】同上実施例の９０度回転した面の部分断面図で

ある。

【図４】同上実施例を下方より見た部分斜視図である。

【図５】同上実施例を真上より見た平面図である。

【図６】従来例の問題を説明する部分断面図である。

【図７】本発明の効果を説明する部分断面図である。

【図８】本発明の１実施例の１製法を示す図である。

【図９】同上実施例の１製法を示す図である。

【図１０】同上実施例の１製法を示す図である。

【図１１】本発明の製造方法を説明する部分断面図である。

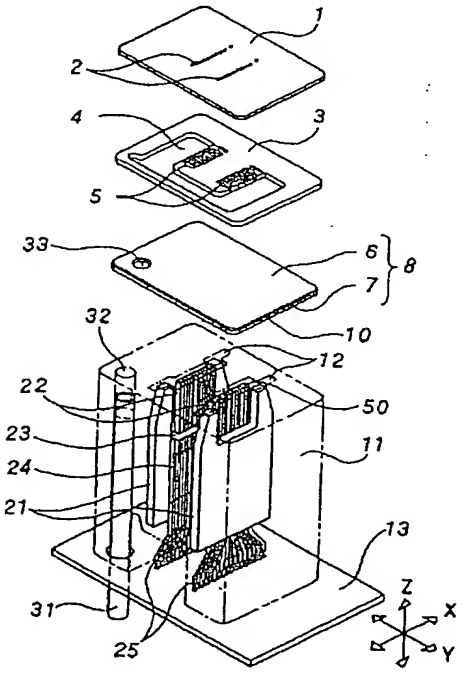
【図１２】本発明の他の実施例の部分断面図である。

【図１３】本発明の他の実施例の部分断面図である。

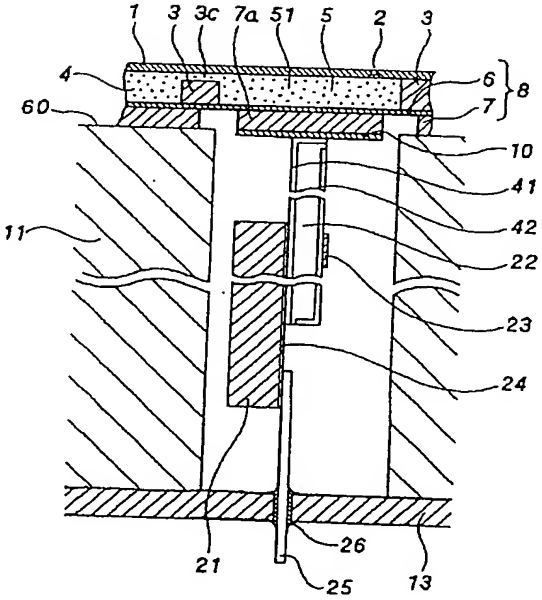
【符号の説明】

１、１ａ	ノズル基板
３、３ｄ	キャビティ形成基板
５	インク室
６	金属薄板
７、７ａ、７ｂ	壁部材
８、８ａ	弾性部材
９ａ、９ｂ、９ｃ、９ｄ、９ｅ、９ｆ	接着剤の流動硬化状態
１０、１０ｄ、１０ｅ、１０ｆ、１４、１５、１６	中＊間部材
１０ａ	流動性物質
１１	ヘッドフレーム
１２	取り付け穴
２１	固定台
２２、２２ａ	圧電素子
２３	共通板
２４	配線パターン
２５	リードフレーム
２７	脚部
２８	軸受構成部材
３１	インク供給管
３２	インク接続口
３３	インク連絡口
５１	インク
６０	ヘッドフレーム平面
６１	感光性樹脂フィルム（ドライフィルム）
６２	ガラスマスク
９０	キャビティ形成基板完成体
９１	ガラスマスク（基準平板）

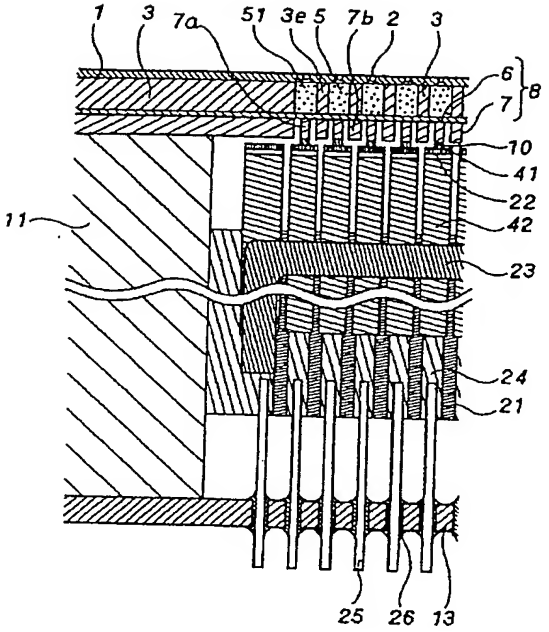
【図１】



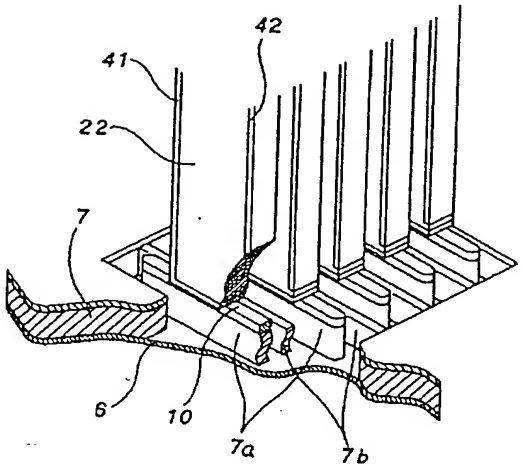
【図２】



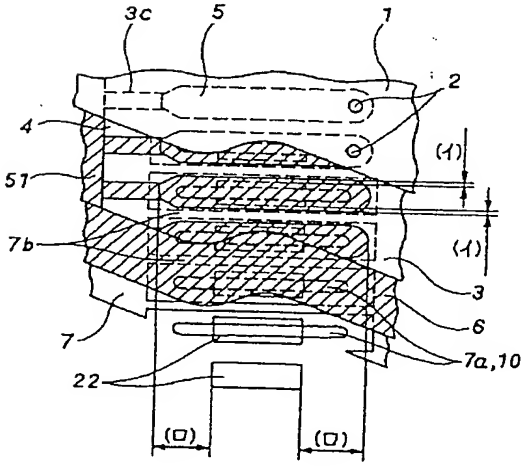
【図3】



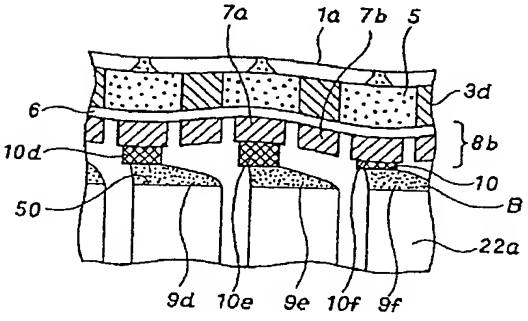
【図4】



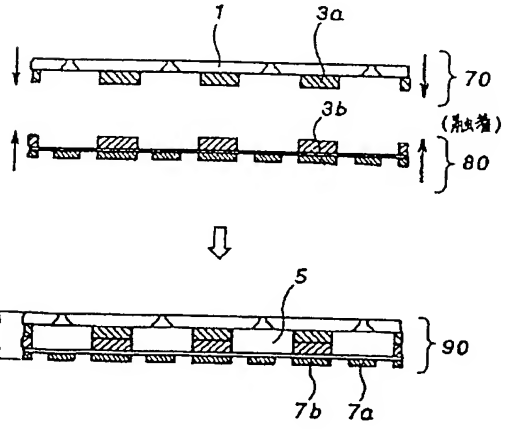
【図5】



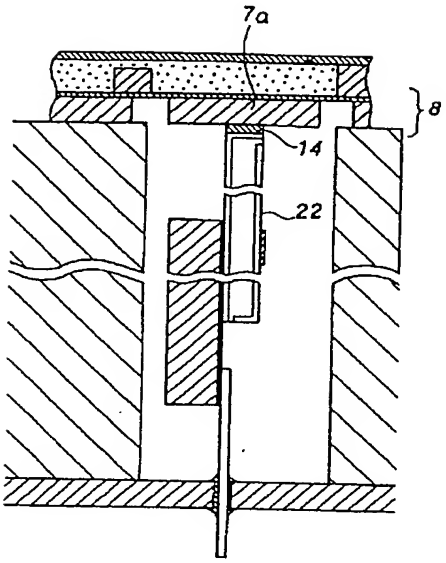
【図6】



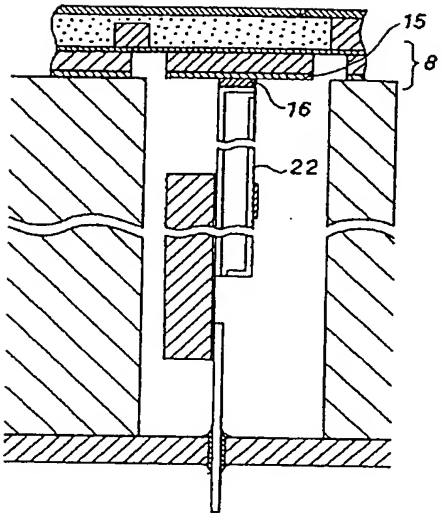
【図10】



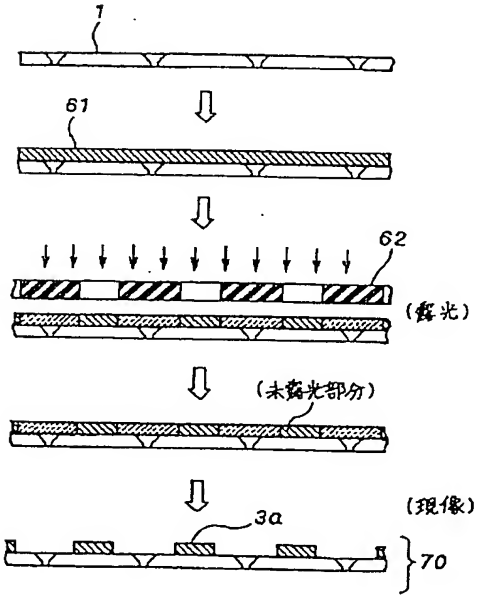
【図７】


7a
8
14
22

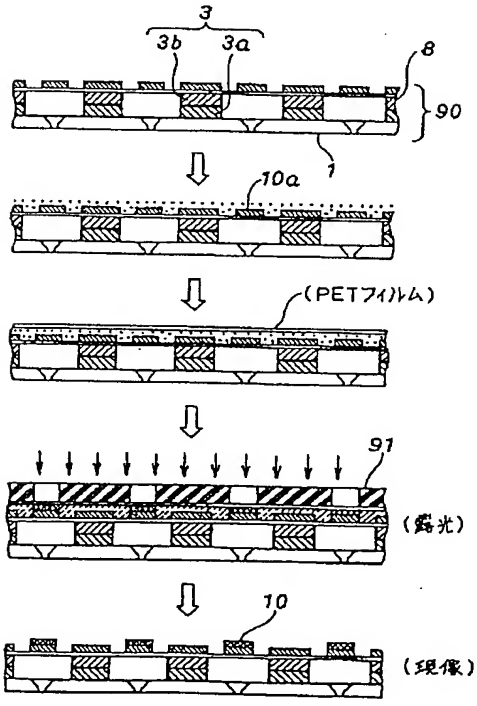
【図８】


15
8
16
22

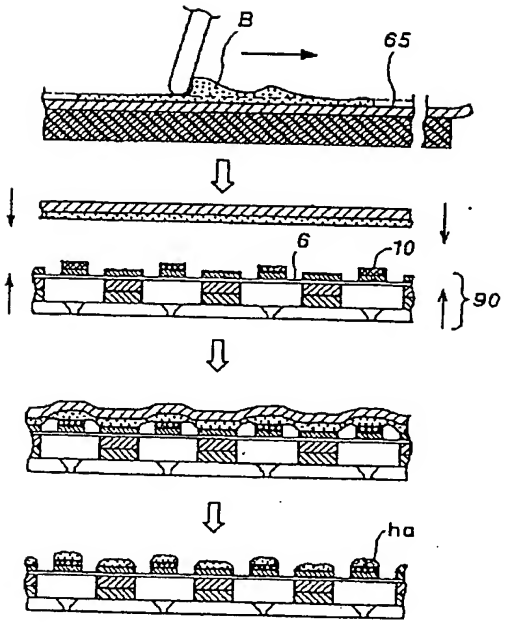
【図９】


1
61
62
(露光)
(未露光部分)
(現像)
3a
70

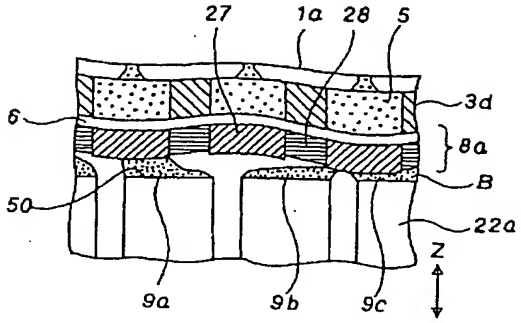
【図１１】


3
3b
3a
8
90
1
10a
(PETフィルム)
91
(露光)
10
(現像)

【図12】



【図13】



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【手続補正書】
【提出日】平成１１年６月１日（１９９９．６．１）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】全文
【補正方法】変更
【補正内容】
【書類名】明細書
【発明の名称】　インクジェット式印字ヘッド及びその製造方法
【特許請求の範囲】
【請求項１】　ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、前記弾性部材を前記圧電素子によって変位させてインク室内のインク圧力を高め、前記ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、
前記弾性部材と前記圧電素子が当接する部分に前記弾性部材と前記圧電素子の距離のバラツキを、前記当接する部分毎に補正する中間部材を設けたことを特徴とするインクジェット式印字ヘッド。
【請求項２】　前記圧電素子の並び方向における前記中間部材の幅は、前記弾性部材及び前記圧電素子の幅より狭く、接着により固定されていることを特徴とする請求項１記載のインクジェット式記録ヘッド。
【請求項３】　請求項１または請求項２記載のインクジェット式印字ヘッドの製造方法において、接着剤を薄膜状に塗布し、前記接着剤の薄層を、接合固定される前記弾性部材あるいは前記圧電素子あるいは形成された前記中間部材に転写し、前記弾性部材と前記圧電素子とを押圧、固定することを特徴とするインクジェット式印字ヘッドの製造方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、印字信号に応じてインク滴を吐出して、記録紙等の記録媒体上にインク像を形成するオンデマンド型インクジェット式プリンタの記録ヘッド及びその製造方法に関する。
【０００２】
【従来の技術】印字信号に応じてインク滴を飛翔させる、いわゆるオンデマンド型インクジェット式プリンタの記録ヘッドは、日本特許公報特公平２－４５９８５号や特公平２－５２６２５号に示されたように、一端が基台に固定された圧電素子の他端を、インク室を形成する容器の弾性壁に、脚部を介して当接させて構成される。この脚部は弾性壁を構成する部材に隣接する部材内の円柱形開口の軸受手段に沿った並進運動をしている。同公報の技術によると、圧電素子を収縮させてインク室体積を増大し、再び圧電素子を伸長させることでインク室体積を減少させインクをノズルから液滴として吐出している。更に同技術の構成は、脚部を軸受手段に線接触させて支持させる構造をとっている。
【０００３】
【発明が解決しようとする課題】記録ヘッドの小型化、高密度化を図るほど圧電素子やインク室の寸法は小さくなる。前出の公報の構成では、脚部部材や脚部挿入軸受構成部材等、複雑なる形状の部材を積層する構造であり、小型化した各部材の寸法を高精度に管理し製造することが非常に困難である。つまり圧電素子からの発生力を伝達する脚部と脚部挿入軸受構成部材との接触状態を複数のインク吐出装置において必要精度を得ることが困難であるという問題点を有する。
【０００４】また、圧電素子からの発生力の伝達が、インク吐出装置の相互間で、複数の脚部を同一の脚部挿入軸受構成部材内で並進運動させるために干渉するという問題点を有する。
【０００５】更に、圧電素子と脚部の結合手段で、圧電

素子の圧電素子長軸に横断方向の側方運動を阻止する脚部構造への圧電素子の位置合わせまたは係合手段を圧電素子と脚部に配設した場合の位置合わせは、寸法の小さくなった、剛性の低下した圧電素子を定位置へ組み込ませることとなり、圧電素子への前記横断方向への負荷が加わり、圧電素子の信頼性を損なうという問題点を有する。

【０００６】その上、脚部と弾性壁間に機械的結合手段を用いているため結合部の剛性が低く、インク吐出の高速応答性が得られないという問題点を有する。

【０００７】そこで、本発明の全体的な目的は、圧電変換器と弾性壁との間の改良された結合構造を提供することにある。

【０００８】本発明の他の目的は安価な結合方法を提供することにある。

【０００９】本発明の他の目的は容易に量産できる結合構造かつ結合製造方法を提供することにある。

【００１０】本発明の他の目的は圧電素子発生力損失の少ない、複数のインク吐出装置で均一なる性能の発揮できる結合方法を提供することにある。

【００１１】本発明の他の目的はインク吐出装置の相互間の干渉を防ぐ結合構造を提供することにある。

【００１２】本発明の他の目的は信頼性を有する結合方法を提供することにある。

【００１３】本発明の他の目的はインク吐出の高速応答性の有する結合方法を提供することにある。

【００１４】

【課題を解決するための手段】本発明のインクジェット式印字ヘッドは、ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、弾性部材を圧電素子によって変位させてインク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、弾性部材と圧電素子が当接する部分に弾性部材と圧電素子の距離のバラツキを、当接する部分毎に補正する中間部材を設けたことを特徴とする。

【００１５】また、係るインクジェット式印字ヘッドにおいて、圧電素子の並び方向における中間部材の幅は、弾性部材及び圧電素子の幅より狭く、接着により固定されていることを特徴とする。

【００１６】また、係るインクジェット式印字ヘッドの製造方法において、接着剤を薄膜状に塗布し、接着剤の薄層を、接合固定される弾性部材あるいは圧電素子あるいは形成された中間部材に転写し、弾性部材と圧電素子とを押圧、固定することを特徴とする。

【００１７】

【実施例】図１は本発明の一実施例の構成を示す斜視図であり、組立後に各部品を分解したものである。図２、図３、図４、図５はそれぞれ、同実施例をより詳細に描いた部分断面図、同実施例の前記部分断面図を９０度回転した部分断面図、同実施例を下方より見た部分斜視図、同実施例を真上より見た部分平面図を示す。尚、図５は構成部品を上より順次透過した状態を示す。図１３は従来の問題点を説明する部分断面図、図６は本発明の構造での効果を説明する部分断面図を示す。図９、図１０はインク室の製造方法の一実施例を説明するための部分断面図を示す。図１１は本発明の実施例の構成に基づいて、中間部材を形成する製造方法を説明するための部分断面図を示す。図１２は本発明の実施例に基づいて、本発明の製造方法を説明するための部分断面図を示す。図７、図８は本発明の他の実施例を説明するための部分断面図を示す。

【００１８】これらの図において、１はノズル基板である。ノズル基板１には、複数のノズル２を設けてある。３はキャビティ形成基板である。キャビティ形成基板３は、ノズル基板１と、弾性壁となる弾性部材８とで挟まれて、リザーバ４とインク室５を形成する。弾性部材８は、金属薄板６と壁部材７とからなる積層構造を成す。弾性部材８、キャビティ形成基板３、ノズル基板１は順次密着接合されキャビティを形成した後、後述する中間部材１０を弾性部材８側に形成し、ヘッドフレーム１１上に密着接合されている。

【００１９】図１をもとに本発明を説明する。インク滴吐出の駆動源となる圧電素子２２は、その長手方向の約半分の一面を固定台２１に固着され、固着されない半分の先端５０を中間部材１０と接合している。固定台２１には正極と負極の導通配線パターン２４が施され、リードフレーム２５を介して、制御基板１３により制御された電界を圧電素子２２に与える。１１はヘッドフレームである。１２はヘッドフレーム１１内を貫通する取り付け穴で、圧電素子２２のＸ，Ｙ方向の位置合わせ（図１のＸＹＺ座標参照）をするべく固定台２１を支持する。尚、圧電素子２２のＺ方向は、中間部材１０と弾性部材８とキャビティ形成基板３とノズル基板１を接合した接合体を、ヘッドフレーム１１に接合後、圧電素子２２の先端５０を中間部材１０に当接して位置合わせする。

【００２０】３１はインク溜部（図示せず）からインク５１を供給するインク供給管である。インク供給管３１は、ヘッドフレーム１１に圧入接合されている。インク流路は、ヘッドフレーム１１にあるインク接続口３２と弾性部材８にあるインク連絡口３３を経て、キャビティ形成基板３のリザーバ４、更にインク室５と連通している。以上が概略構成である。

【００２１】図２、図３に従って、構造について更に詳しく述べる。図２は複数並列（図１のＸ方向）する圧電素子２２の、一本の圧電素子を図１のＹ方向へ中央より切断したときの部分断面図である。弾性部材８の圧電素子２２が中間部材１０を介して当接する壁部材７ａは、圧電素子２２の当接部断面積よりインク室断面積が大きいために、インク室５の弾性壁の変位量を可能な限り大

面積で均一に得るため、金属薄板６に対して剛性の補強を図っている。圧電素子２２は、一方の電極４１と他の一方の電極４２が対向している。電極４１は、固定台２１上の配線パターン２４に接合と同時に電気接続されている。他の電極４２は、共通板２３により、固定台２１上の配線パターン２４、特に電極４１に反する電極と電気接続している。配線パターン２４と制御基板１３とをリードフレーム２５で結び、それぞれ接続箇所を半田２６で固着している。尚、固定台２１は、圧電素子２２が中間部材１０に当接した状態で、ヘッドフレーム１１に接合固定されている。つまり、圧電素子２２のＺ方向は中間部材１０で位置合わせする。壁部材７と当接するヘッドフレーム１１の平面６０は、平面研磨等の手段により高精度に仕上げられている。

【００２２】図３は複数並列する圧電素子２２の図１のＸ方向へ中央より切断したときの部分断面図である。ノズル基板１とキャビティ形成基板３と弾性部材８とは密着接合した積層構造であり、密着接合させるために、弾性部材８の壁部材７はノズル基板１と弾性部材８とに当接する、インク室間を隔てる壁３ｅに接合圧力を加えることが必要であり、圧電素子２２からの発生力を伝達する壁部材７ａとは別に壁部材７ｂを配設する。

【００２３】一方、図５のごとくインク５１が充填されるインク室５及びリザーバ４は、キャビティ形成基板３とノズル基板１と弾性部材８とで形成される。キャビティ形成基板３は、ガラスのエッチング加工、金属薄板の積層、感光性樹脂の露光形成、樹脂の射出成形等で作ることができるが、本実施例では、コスト的に安価な感光性樹脂を用いている。キャビティ形成基板３の上面を覆うノズル基板１は、プレス加工によって、複数のインク室５にそれぞれ一つずつノズル２が開けられた、０．１ｍｍ程のステンレス鋼板からなる。ノズル基板１は、ニッケルの電鋳加工法によっても作ることができる。また、キャビティ形成基板３の下面を覆う弾性部材８は、ニッケルの電鋳加工法で５μｍ以下の厚さに形成した金属薄板６に、同加工法で１０～１００μｍ程度の厚さに形成した壁部材７を積層した構造をなす。壁部材７は、レジストを塗布することで容易に必要なる形状を得ることが出来る。金属薄板６は、圧電素子２２の伸縮をインク室５に効率良く伝えるために薄いほど好ましいが、インク室５内のインク５１がしみ出してはならない。インク５１が導電性を呈する場合、圧電素子２２の一方の電極４１と他の一方の電極４２間や制御基板１３にインク５１が付着して、電気的にショートしてしまうからである。また、金属薄板６をフィルム等の樹脂で代替することもできる。圧電素子２２を金属薄板６に直接接合すれば構成としては簡素になるが、以下の理由によりこれができない。一つの理由として、図２に示すように、電極４１が金属薄板６と接触すると隣接する圧電素子が短絡してしまう。仮に、電極４１側を共通電極とした場合には、インク５１に電界が加わることになる。このことは、インク５１が経時的にイオン化して、信頼性の劣化を招くことにつながる。そこで、中間部材１０に絶縁部材即ち感光性樹脂を配することにより上記の問題から解放され、圧電素子２２を制御するための配線の自由度が増すことになる。もう一つの理由は、図５に示すように、圧電素子２２の断面形状とインク室５の断面形状が、コスト面及び製造上の理由から異なることにある。このことは、圧電素子２２がインク室５を加減圧する際、図５に示すように、変位できる弾性部材８の長さ（イ）が短すぎて充分にたわむことができず、逆に変位できる弾性部材８の長さ（ロ）は長すぎて発生する圧力を吸収してしまう。よって、圧電素子２２の変位を効率良くインク室５に圧力伝達するために、長さ（イ）（ロ）を適切に確保できる中間伝達部材が必要となる。上記理由から剛性を有する壁部材７ａが必要とされる。従って、壁部材７ａは、図５に示すようにたわみ量が確保できるように、インク室５の投影面より一回り小さく設計されている。壁部材７ａは、電鋳加工法によって図４に示す形が作られる。また、図６に示されるように、島状部である壁部材７ａの端面は、圧電素子２２の先端５０と壁部材７ａとの位置合わせのマージン増大のため中間部材１０が形成され、これに圧電素子２２の先端５０が接合されている。

【００２４】ここで、インク滴吐出動作を図２を用いて説明する。印字信号に応じて制御基板１３からリードフレーム２５、配線パターン２４を通じて圧電素子２２の一方の電極４１と他の一方の電極４２とに電界を印加する。電界を印加された圧電素子２２は長手方向（同図上下方向）に収縮しようとする。この時、圧電素子２２の下半分は、ヘッドフレーム１１に保持される固定台２１に固着されており、収縮変位できない。一方、圧電素子２２の上半分は、他の拘束を受けることなく収縮変位して、その収縮力により中間部材１０を介して弾性部材８を引張る。中間部材１０を介して圧電素子２２に引張られた弾性部材８の金属薄板６が下方へたわみ、その結果インク室５の体積が膨張する。インク室５が膨張すると、リザーバ４からインク供給口３ｃを通じてインク５１が流入する。次いで、圧電素子２２の電界を解除すると、圧電素子２２は元の長さに伸長してインク室５を圧縮する。この圧力でノズル２からインク滴を吐出する。圧電素子２２の変位をインク室５に伝える中間部材１０と弾性部材８の壁部材７ａは前述したように、インク室５の投影面より一回り小さいため、金属薄板６のたわみ部を残しつつインク室５をまんべんなく加圧及び減圧する。

【００２５】ところで、本発明の中間部材１０を形成しない従来の結合構造例では、複数のインク室５が密接し、一対一に脚部２７を配設する。圧電素子２２ａと脚部２７は、発生力伝達時損失をなくすため当接後直接接

合する。しかし、寸法が極端に小さな構造の位置合わせで、図１３に示すごとく圧電素子２２ａが隣接する脚部２７に端部が掛かり、隣接インク室５、５、５‥‥間で干渉する恐れがある。また、接着剤が部分的に多量に塗布されることで振動部である弾性部材８ａが軸受構成部材２８と共に固化されてしまう危険性も高い。従って、この間隙には、圧電素子２２ａと弾性部材８ａとを接合するために必要最小限の接着剤を塗布することが必要となる。接着方法としては、一般に一定量の接着剤を圧電素子２２ａまたは弾性部材８ａに、各塗布部に塗布厚バラつきがでないように塗布した後、両者を当接した状態で保持し同接着剤を硬化させている。これ以外では、例えば、圧電素子２２ａと弾性部材８ａとを当接後、圧電素子２２ａと弾性部材８ａとの各間隙に応じた適度な量を充填することが考えられるが、構造上、製法上制約が大きく実現する可能性は極めて小さい。そこで、一定量の接着剤を管理しながら塗布する方法を採ることとなる。

【００２６】圧電素子２２ａと弾性部材８ａとの位置合わせが寸法が極端に小さな構造で困難である場合、接着剤の接合状態において図１３の９ａ、９ｂ、９ｃ、‥‥のごとく、バラつきの大きい状態が形成されることとなる。ここでは、代表的な３タイプを図示しているが、実際にはもっと多くの接合状態が生じている。９ａは、圧電素子２２ａから弾性部材８ａへの動圧伝達には問題無い接合状態を示し、接合としては安定して硬化している。これは、即ち弾性部材８ａあるいは圧電素子２２ａ上の接着剤が適量に保たれているからである。一方、９ｂは接合するべき脚部２７の隣接する脚部２７へ接合した状態を示す。この状態においては、目的外の不必要なインク室５からのインクの吐出が生ずることとなる。９ｃは接着剤塗布量の過剰であることと、ノズル基板１ａ、キャビティ形成基板３ｄ、弾性部材８ａ、軸受構成部材２８の製造過程により生ずる厚み方向のバラつきや反りにより脚部２７と圧電素子２２ａとの間隙が狭くなることが起因して、軸受構成部材２８をも接合している状態を示す。この状態はまた、脚部２７と軸受構成部材２８とは滑らかに動作しなければならない関係から、圧電素子２２ａ変位方向において前記二部材は大きな断差を形成することができなく、従って壁部材７ａならびに圧電素子２２ａ上の接着剤Ｂを９ｃのように容易に取り込み易く、圧電素子２２ａの伸縮が阻止されることとなる。よって、接着剤Ｂの流出を防ぐために圧電素子２２ａの固着されない半分の先端５０と脚部２７の当接面との間隙を適切で均一な状態にすると共に、脚部２７と軸受構成部材２８と少なくとも接着剤の塗布高さｈａ程度に段差をつけることが重要である。

【００２７】一方図６は、本発明で実施される中間部材１０を設けたことによる効果を説明する部分断面図である。また、脚部２７と軸受構成部材２８間の摩擦に対し対策を講じた構造を示している。同図において、後述する方法で中間部材１０を形成し、圧電素子２２ａと接合された状態を示す。中間部材は同図のごとく、１０ｄ、１０ｅ、１０ｆ‥‥で、前述したノズル基板１ａ、キャビティ形成基板３ｄ、弾性部材８ｂの製造過程による厚み方向のバラつきやソリを補正し、９ｄ、９ｅ、９ｆで示すように、適度な間隙を形成している。また、後述する製造方法により中間部材１０の高さと隣接壁部材８ｂとの段差を活かし接着状態を安定して形成している。その上、壁部材８ｂ上へ接着剤Ｂを塗布した場合においても隣接する壁部材８ｂ上の接着剤Ｂを圧電素子２２ａに引き込むことがなくなる。

【００２８】その他前述の実施例以外にも、例えば図７のように、圧電素子２２側に中間部材１４を形成することもできる。また、図８のように、圧電素子２２側に中間部材１６を形成し、弾性部材８側に中間部材１５を形成することもできる。

【００２９】次に図９、図１０に従って弾性部材８とキャビティ形成基板３とノズル基板１との接合体の製造方法について述べる。図９、図１０は圧電素子２２の複数並列方向から見た断面を示すものである。キャビティ形成基板３の製造法としてはプレス加工、電鋳成形、エッチング等の方法があるが、ここでは最も容易なる感光性樹脂フィルムを用いた製法で、ノズル基板１と弾性部材８の各々へキャビティ形成基板３を２部に分割して形成し、後に分割形成した２部を融着して仕上げる方法について説明する。最初に、図９を用いキャビティ形成基板３のノズル基板１側のキャビティ形成について説明する。前述のごとくプレス加工または電鋳加工法によって加工されたノズル基板１に感光性樹脂フィルム（以下ドライフィルムと呼ぶ）６１をラミネートする。次に紫外線を露光するパターンと露光しないパターンを形成したガラスマスク６２をドライフィルム６１側に配し、紫外線を照射し露光を行う。露光後には、ドライフィルム６１上に、露光によって硬化した部分と露光されない未露光部分が形成される。次に、現像を行うことによって未露光部分を除去し、キャビティ形成基板３ａとノズル基板１の接合体７０が完成する。

【００３０】一方、図１０のように弾性部材８側も前記キャビティ形成基板３ａと同様にして電鋳加工法によって加工された弾性部材８上にキャビティ形成基板３ｂを形成することで接合体８０が完成する。そして、キャビティの完成体は、キャビティ形成基板３ａとノズル基板１との接合体７０とキャビティ形成基板３ｂと弾性部材８との接合体８０の両者を当接し、１５０～１７０℃の温度で融着することによって、キャビティ形成基板完成体９０が製造される。この時、ドライフィルム表面は熱によって融着されるが、加圧力と時間によってドライフィルムのつぶれ量が決定される。また、加圧が均等に成されることがドライフィルムのつぶれ量のバラつきを少

なくする上で重要となる。そこで加圧均等を目的に、キャビティ形成基板３ａとキャビティ形成基板３ｂとが当接する位置には、壁部材７ｂを配設してドライフィルムのつぶれ量のバラつきの安定化を図っている。そのため、隣接するインク室５、５、５‥‥間に壁部材７ｂが配設され、壁部材７ａとの間隔が密となり高密度配列が困難となる。よって、圧電素子２２との接合時に中間部材１０を設けることが重要になる。また、実際には、ドライフィルム上における融着肉の有無即ちパターンの配し方によって、つぶれ量のアンバランスが起こり易い。また、融着時の加熱から常温への冷却過程では、ソリが発生しやすくなる。以上の理由から、製造時にキャビティ形成基板完成体９０の厚みｈのバラつきが発生しやすくなっている。従って、圧電素子２２と弾性部材８との間隙バラつきにおいても中間部材１０は重要な役割を果たすこととなる。

【００３１】図１１は、前記中間部材１０を形成する過程を示す。９０は、キャビティ形成基板完成体である。まず、キャビティ形成基板完成体９０の弾性部材８側に、中間部材１０を形成する流動性物質１０ａを塗布する。必要に応じて、塗布前に密着力向上を目的として、弾性部材８にプライマー処理を施すこともある。流動性物質１０ａは、感光性樹脂、熱硬化性樹脂、常温硬化性樹脂があげられるが、特にポリエステル樹脂、アクリル樹脂、エポキシ樹脂、ＡＰＲ樹脂、各種レジストが使用される。本実施例では、比較的簡単に扱えコスト的にも安価なポリエステル樹脂（感光性樹脂）を用いている。次に、弾性部材８の最も凸となる部分から、一定の距離を離間せしめる、少なくとも後述の中間部材１０上への転写接着剤高さｈａ（図１２）以上の、間隙部材（図示せず）を設けた部分に、離型性を目的としたＰＥＴフィルムを、少なくとも流動性物質１０ａよりも広い範囲に載置する。次に、前記フィルム上に平坦の基準となるガラスマスク９１を載置する。

【００３２】このガラスマスク９１には、流動性物質１０ａに対して露光部と未露光部を選択的に形成する目的で、パターンが配されている。更に、このガラスマスクの少なくともフィルム側の片面は、研磨加工で平面度０．１～０．２μｍ程度に仕上げられている。このガラスマスク９１を載置した後、３００～４００ｎｍ程度の波長を持つ紫外線を照射することによって、露光を行う。流動性物質１０ａは、可視光線４００ｎｍ以上には感光しにくいので、暗室や特別な設備は必要ない。前記露光後には、流動性物質１０ａは２分化され、被露光部は化学変化を起こして硬化し未露光部は流動性の状態を保っている。この状態で、未露光部で流動性の部分の除去を行う。流動性物質１０ａは、弱アルカリ液あるいは水で簡単に除去できるので、作業は安全且つ無害である。また、硬化部分を更に確実に硬化させる目的で、後露光を必要に応じて実施することもできる。その上、未露光部除去時に膨潤した成分の乾燥を目的に６０～８０℃の温度を加えることもある。以上の方法により、中間部材１０を形成することができ、平面精度については前記ガラスマスク９１と同程度な高精度の中間部材１０を形成することができる。尚、本実施例以外でも、前記熱硬化性樹脂や常温硬化性樹脂についても、同様に高精度な中間部材１０を形成することができる。

【００３３】次に図１２に従って高密度に配設したキャビティ形成基板完成体９０上に形成された中間部材１０と圧電素子２２とを、接着塗布量を安定して容易に得ることのできる製造方法について説明する。前記製造方法により形成した弾性部材８の壁部材７ａ上の中間部材１０の平面精度は、前記の通りガラスマスクの平面度程度には仕上げられている。しかし、圧電素子２２ａの固定台と固着されない半分の先端５０と当接することで前記中間部材１０との間隙バラつきが１～３μｍ程度はある。これまでに間隙バラつきは最小限に収められている。そこで、残留バラつきは接着剤Ｂの高さｈａで吸収しなければならない。従って、少なくとも４μｍから、多くても金属薄板６へはみ出さない程度で、接着剤Ｂの高さｈａを中間部材１０上に均一に塗布しなければならない。接着剤Ｂ一定量塗布の方法としては、スピンコート、スプレー印刷、タコ印刷、平板転写、スクリーン印刷があるが、本構造では金属薄板６へのはみ出しが厳禁であるためスピンコート、スプレー印刷、スクリーン印刷は使用できない。また、金属薄板６が５μｍ以下と非常に薄く、タコ印刷では圧力が加わるため金属薄板６の破壊を導き使用できない。平板転写については、一般的に片面が高精度な平面精度を有する平板を用い被転写物へ転写するが、本構造では少量の接着剤Ｂを微量ではあるが平面度バラつきをもつ中間部材１０へと転写しなければならなく、その上圧力を加えられないことを考慮すると、平板転写は一定量塗布にとって不適切な方法となる。そこで、本発明の構造に対しては転写印刷法の一つであるフィルム転写により、フィルムが平面度のバラつきに追従する特徴を活かし高精度に転写高さｈａを管理した塗布を行なう。

【００３４】製造方法は、図１２に示すように片面を０．１～０．２μｍ程度に仕上げてある平板へ、本実施例ではポリイミドの５μｍ～２０μｍのフィルムを密接し、上部に接着剤Ｂのフィルム上での高さを管理し、転写に必要な面積を制限するスペーサー６５を設置する。このスペーサーの塗布範囲内に接着剤Ｂを滴下し、余分な接着剤Ｂを端部が線状に平坦性を有するかき取り板で排除する。この一連の工程を迅速に行うことで、スペーサー厚と同程度の接着剤Ｂ高さを得る。そして、スペーサーを排除した後、接着剤Ｂの塗布されているフィルムを中間部材１０上へ接着剤Ｂの表面張力を利用して置く。接着剤Ｂの塗布されているフィルムは柔軟であるためキャビティ形成基板完成体９０の表面形状に追従して

接着剤Ｂの粘性により引き寄せられる。この時、接着剤Ｂ塗布部に気泡が混入しないように徐々にフィルムを中間部材１０及び壁部材７ｂ上へと置いていく。接着剤Ｂの当接した部分は、このフィルムを除去すると、均一高さｈａに転写された接着剤Ｂを得る。フィルム転写は、被転写物の平面度に拘らず被転写物の形状に追従するため、接着剤Ｂの転写量はいずれの転写部分においても均一に転写される。本被転写物は、表面が矩形の連続であり、中間部材１０が高所となっているため接着剤Ｂがその側面に少量塗布される。従って接合時の接着剤メニスカス形状が中間部材１０の側面まで至り接合高強度を得ることができる。フィルム転写の特徴は、フィルムの剛性やフィルムの種類を被転写物の表面形状に合わせ選択し、接着剤の主成分、粘度を被転写物の表面積、表面状態に適したものを選択することで、様々な複雑なる表面形状、表面粗さの部品の接着剤塗布が塗布厚均一に容易に行える。以上のように容易なる方法で得られた中間部材１０上の均一高さｈａの接着剤Ｂに、図６のように圧電素子２２ａの固定台と固着されない半分の先端５０と当接することで、圧電素子２２ａは壁部材７ｂと接合することなく、また金属薄板６へ接着剤が流出することなく安定して壁部材７ａと接合することができる。

【００３５】以上述べたごとく形成した圧電素子２２と弾性部材８との結合構造は、圧電素子２２の発生力を損失無くインク室５へ伝達できるものである。特徴としては、個々のインク吐出装置において、圧電素子２２と弾性部材８間の結合構造は他からの拘束を全く受けないことにある。また中間部材１０が樹脂であり軽いこと、その上接着剤塗布量が安定し中間部材１０を設けていることにより位置合わせにマージンが広く取れ、容易に的確に当接するべく圧電素子２２と弾性部材８とを接合できる。

【００３６】

【発明の効果】以上説明したように、本発明のインクジェット式印字ヘッドは、ノズルと、該ノズルと連通するインク室と、該インク室の一部を形成する弾性部材と、該弾性部材と結合する圧電素子とを備え、弾性部材を圧電素子によって変位させてインク室内のインク圧力を高め、ノズルからインク滴を吐出させるインクジェット式印字ヘッドにおいて、弾性部材と圧電素子が当接する部分に弾性部材と圧電素子の距離のバラツキを、当接する部分毎に補正する中間部材を設けたことにより、中間部材によって隣接部材との断差を管理することができるため、隣接壁部材との接合を防ぐことができ、平面方向で圧電素子の弾性部材に対する位置合わせのマージンを広くとることができ、圧電素子はその変位方向の横断方向に結合による負荷が加わらないため信頼性が得られる。その結果、圧電素子の変位を忠実且つ効率良くインク室に伝えることができるようになり、高速応答性を有するインク吐出特性の安定した高密度ヘッドを得ることができるという効果を有する。

【００３７】また、係るインクジェット式印字ヘッドにおいて、圧電素子の並び方向における中間部材の幅は、弾性部材及び圧電素子の幅より狭く、接着により固定されていることにより、並列に密接して配設されるインク吐出装置の圧電素子と壁部材間の結合構造で、接着剤流出による他との剛体化を防ぐことができ、インク吐出装置の高密度配列を可能にする。また、各部材間を強固に接合により結合させるため高速応答性を実現できるという効果を有する。

【図面の簡単な説明】

【図１】本発明の１実施例の構成を示す斜視図である。

【図２】同上実施例の部分断面図である。

【図３】同上実施例の９０度回転した面の部分断面図である。

【図４】同上実施例を下方より見た部分斜視図である。

【図５】同上実施例を真上より見た平面図である。

【図６】本発明の効果を説明する部分断面図である。

【図７】本発明の他の実施例の部分断面図である。

【図８】本発明の他の実施例の部分断面図である。

【図９】本発明の１実施例の１製法を示す図である。

【図１０】同上実施例の１製法を示す図である。

【図１１】同上実施例の１製法を示す図である。

【図１２】本発明の製造方法を説明する部分断面図である。

【図１３】従来例の問題を説明する部分断面図である。

【符号の説明】

１、１ａ　ノズル基板
３、３ｄ　キャビティ形成基板
５　インク室
６　金属薄板
７、７ａ、７ｂ壁部材
８、８ａ　弾性部材
９ａ、９ｂ、９ｃ、９ｄ，９ｅ，９ｆ　接着剤の流動硬化状態
１０、１０ｄ、１０ｅ、１０ｆ、１４、１５、１６　中間部材
１０ａ　流動性物質
１１　ヘッドフレーム
１２　取り付け穴
２１　固定台
２２、２２ａ　圧電素子
２３　共通板
２４　配線パターン
２５　リードフレーム
２７　脚部
２８　軸受構成部材
３１　インク供給管
３２　インク接続口
３３　インク連絡口

５１	インク	６２	ガラスマスク
６０	ヘッドフレーム平面	９０	キャビティ形成基板完成体
６１	感光性樹脂フィルム（ドライフィルム）	９１	ガラスマスク（基準平板）